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FLIGHT

The AIRCRAFT ENGINEER AND AIRSHIPS

FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

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Lifting the Veil

EMPIRE Air Day has been marred by some deplorable accidents, which everyone regrets, but, despite them, it has done good service by teaching the public some very useful lessons about the new and mysterious art of flying. The Air Ministry and civil aerodromes and clubs combined, in response to the requests of the Air League, to lift the veil from the face of the mystery, and nothing but good can come of this taking of the public into the confidence of the flying experts—apart from the very considerable benefit to Service charities.

The public is still inclined to look upon flying as something of a stunt, and if people are to be attracted to aerodromes and to learn something useful from their visits, it is necessary to use some circus attractions as a bait. Just as the crowd which pays to see a circus expects to see bareback riding, jumping through hoops, and tamers boldly entering the lions' cage, so does the aerodrome public want to see some trick flying. This not unnatural craving for the spectacular was wisely gratified at practically every aerodrome last Saturday, but the flying displays were perhaps the least useful part of the day's functions. The visitors, especially at the Service stations, were shown all manner of things which could not fail to interest them, and which gave them a good working knowledge of how the R.A.F. does its job. Not only the aeroplane itself, but such matters as the automatic pilot, parachutes, machine guns, instruments, rigging, engine fitting, wireless lorries, and many others were demonstrated and explained.

On such an occasion it is not possible to show in a concise and telling fashion the greatest of all the romances connected with flying, namely, the daily passage of commercial aircraft from place to place across the British Empire, the thousands of miles flown with safety and regularity according to schedule, with no thought of danger or sensation. To those who cannot make the journeys from Croydon to India, Australia, and Capetown, only the cinematograph can give any clear picture of the marvel in a short time. What Kipling called "the romance of the 9.15" is not concerned with looping and formation flying, still less with bombs or machine guns. Nevertheless, the more that the public knows about aircraft and their accessories, the better, and the amusement and instruction given to many thousands last Saturday must have gone a considerable way towards making the public accept aircraft as scientific facts rather than regard them as the marvels of a conjurer.

The Air Navigation Debate

TWO conclusions emerge from the debate in the House of Commons Committee on the money clauses of the Air Navigation Bill. One is that the Government had really no alternative but to entrust the plans for an air service across the North Atlantic to Imperial Airways, and the other is that the Government has decided that the time has now come when Imperial Airways are no longer to be regarded as the only and inevitable concern for developing other great air services. It might be urged that these two conclusions do not hang well together; that if the time has come for granting subsidies to other companies, then the North Atlantic route should have been thrown open to tender, while if Imperial Airways be the only fit company to undertake that route, then they must still be the best agents for such other routes as the South Atlantic. Five companies, it was stated by Sir Philip Sassoon, are ready to submit plans for the South Atlantic, and lovers of the dilemma form of argument may hold that either none of them is likely to run that

route so well as Imperial Airways could do, or that one or all of them should have been allowed to tender for the North Atlantic service also. The dilemma, however, is a most popular form of fallacy, and should be distrusted wherever it crops up. The first object of the Government while air transport was still an infant industry (and it still may be called so) was to ensure success in operation at the lowest cost. That implied a concentration not only of subsidy but of experience and all kindred resources. Imperial Airways are the outward and visible sign of that policy, and it has been only prudent to continue that policy at least until one great trunk route to each of the four continents, Asia, Africa, Australia, and America, had been established. That monopoly could not endure for ever. Imperial Airways blazed the trail, but others can see the marks on the trail, and inevitably the time must come when other companies will arise whose claims to share in the work cannot wisely be overlooked.

Naturally there were complaints from the Socialist party because the Government has not considered a State-owned airway, on the plan of the State railways which flourish in India and in many Continental countries. The House of Commons Committee, however, showed little sympathy with this proposal. In general it showed a tendency towards impatience at the connection which exists between the Government and Imperial Airways, and an anxiety to see air transport take its place among ordinary capitalistic commercial enterprises. The time for that is not yet. As Sir Philip Sassoon explained, and no one doubts it, if subsidies were now to be withdrawn, all British air lines would at once cease to operate. He made it strikingly clear that the same applies even more strongly to all the great foreign air lines, and proved by figures that we British pay less than anyone else for our air transport. He showed also that Imperial Airways is the most popular air company in the world, and, if the one point of speed be omitted for the moment, it may be acclaimed as the best. The question of speed is being tackled, and the programme of a four-and-a-half-day schedule to Capetown and a week to Australia is one of which the greatest worshipper of speed need not be ashamed.

In his speech Sir Philip Sassoon shed some light on what has hitherto been somewhat of a mystery, namely, the functions of the Warren Fisher Standing Committee. It is composed of members from all interested Departments of Government, and it advises the Air Ministry on such points as the choice of an air-mail contractor. It thus becomes clear that the Air Ministry has no autocratic powers in such matters, and the selection of a certain company for subsidy and mail contract on a certain route may therefore be described justly as a decision of the Government.

SPECIAL FOR SPAIN : One of the initial batch of three Hawker Furies for the Spanish Air Force. The engine is a 690 h.p. Hispano Suiza 12Xbrs and the cantilever undercarriage has Dowty internally sprung wheels. At 13,120 ft. the speed is 236 m.p.h. Three squadrons of these machines will eventually be provided. (*Flight* photograph.)

The Outlook

A Running Commentary on Air Topics

Reserve Recruiting

IT is typical of Lord Swinton's energy that he should have tackled the problem of making things easier for pilots and mechanics who join the R.A.F. Reserve. To find time for training without sacrificing the annual holiday has always been one of the difficulties in the way of raising a large and well-trained force from among men who earn their living in civil employ. Lord Haldane had to face that difficulty with the Territorial Force, and still the Territorial Army suffers from it.

Drill, however, has never been a universally popular form of amusement, whereas in these mechanically minded days rigging an aeroplane and fitting an engine are considered highly amusing ways of passing an evening. Consequently, the Auxiliary Air Force has never found any difficulty in getting as many good men as it needs. The appeal of the R.A.F. Reserve is perhaps less direct than that of the A.A.F., for the squadron spirit is lacking in the former. In a world nearer to the ideal than this patriotism might supply all the incentive that was needed; and if war were to break out again patriotism would certainly be the chief factor in producing recruits. In the meantime, the call of the machine will probably find us a good supply, provided that the difficulties of finding time to train are not too great.

A Possible Danger

SINCE giving the details of the foreign guest week-end organised by the Harrogate Club, we have received a letter from a previous licensee of the field at Plompton which, it is proposed, should be used by the visitors. He advises all those who do not know this field to take very special care.

Enquiries have so far failed to confirm the reality of all the dangers which have been pointed out, but our correspondent has had considerable experience of the field in question and his opinion is worth consideration. There is no reason at all why our own pilots should not use it at their own discretion, but it would be more than a pity if one of the visitors was unlucky enough to damage his machine and perhaps himself. By the time this appears in print the matter may have been settled by the Air Ministry, who will have been asked to license it for the purpose of the week-end visit.

Nowadays these matters are largely in the hands of the insurance people, who will not cover a machine—other than the Drone, we believe—for landings in any field save in emergency. If a deliberate landing is made in an unsuitable field then the owner himself must take the financial risk. Which is as it should be.

A Cruiser-carrier

COMPLAINTS about the numerical weakness of the Fleet Air Arm have been rife of late, and have been only too well founded. The Air Ministry has not been to blame, for the Admiralty has only to order the machines which it wants and it gets them. The trouble has been shortage of accommodation on board the cruisers and capital ships which use catapults. The new guise in which H.M.S. *Cumberland* has emerged from her refit shows that this very serious matter is now being tackled in the right spirit. When she went into dock at Chatham fourteen months ago the *Cumberland* had one catapult and one seaplane. Hitherto it has been held that on cruisers there could be no hanger, that aircraft could only be stowed on catapults, and therefore that a ship with only one catapult could only have one seaplane.

This ship has now emerged from the dockyard with considerable alteration. It is true that she still has only one catapult, and that one machine is stowed on it; but she has a hangar before the mainmast which accommodates three more aircraft. All these machines are amphibian flying boats of the Walrus type. In addition, the ship now has deck armour and anti-aircraft guns of the latest kind.

All the cruisers of this class, known as the Washington class, are to be refitted in the same way. H.M.S. *Suffolk* is now in hand at Chatham, and H.M.S. *Kent* will be altered as soon as she has been relieved on the China station by H.M.S. *Cumberland*. In this way a great increase in the air strength of the Fleet will gradually be accomplished.

We Need a Champion

IF there is anything which can be guaranteed to hold the attention of the mass it is a first-class aerobatic exhibition. Offering, as they do, ample scope for individual effort, aerial stunts can be made the subject of some of the most interesting and enthusiastic international rivalry. France, America, and, to a lesser degree, Italy, have realised this, and sportsmen from each of these countries have brought amusement and temporary heart failure to hundreds of thousands. We are sadly out of the picture.

The French meeting at St. Germain-en-Laye recently is a shining example of the magnitude of these international meetings. The Americans, Milo, Burcham, and Joseph Mackey, took over, respectively, a "re-hashed" Boeing pursuit and a taper-wing Waco, and were matched against the mighty Detroyat, Doret, and Massotte. Detroyat was flying a Morane biplane, which he had had built specially for the event; Doret was faithful to his high-wing Dewoitine, and Massotte was on a special Spad.

A friend who tried explaining to us how the show impressed him could only roll his eye-balls and essay Immelmann-like manœuvres with his hands. The most colourful adjectives dropped short by miles.

It seems, altogether, to have been well ahead of anything we have seen over here. What a chance for some of our sporting pilots who continually crave the means of self-expression!

Returning Hospitality

PREPARATIONS are proceeding apace for the International Air Rally—officially known by the rather unbeautiful title of "Week-end Aerien"—which is being held in this country from July 23 to 26. Every British private owner who has toured abroad in his own machine during the many foreign rallies organised from time to time has appreciated the hospitality of his Continental *confrères*. It is the intention of the organisers of the English week end to endeavour to repay this hospitality in some measure, and every effort is being made to make the event a success. It is probable that some 200 guests will attend.

The Private Owners and Hospitality Committee of the Royal Aero Club renews its appeal to all British private owners to come forward and assist the entertainment of the foreign visitors. Having ourselves enjoyed typical welcomes from Continental flying folk over a period of many years, we have pleasure in passing on their request.

EMPIRE AIR DAY

Third of the Series an Even Greater Success in Bringing the General Public to a Better Understanding of Military and Civil Aviation

ON Empire Air Day last year 200,000 people visited Service and civil aerodromes, and the R.A.F. Benevolent Fund benefited to the tune of £4,000. In spite of dull weather at many places last Saturday, all the evidence goes to show that the 1935 total should be equalled, if not handsomely beaten, by the time all the returns have been received at headquarters.

No praise can be too great for the way in which officers and men at the Service stations, and the staffs of the civil aerodromes, co-operated with the Air League of the British Empire to make the day a memorable one for the public, and to give them the utmost value for the humble shilling admission fee.

Almost every aerodrome staged a special flying display, some of them almost as ambitious as the early Hendon Pageants; yet in no instance was this allowed to interfere with that aspect of Empire Air Day which is its greatest attraction—the unique opportunity offered to the public of seeing the daily work of the R.A.F. Nor was it a question of watching this work from a distance; almost everywhere the visitors were free to wander at will, and "Do not touch" notices seemed completely absent.

Even the most confirmed and genuine pacifist would have had to admit the fascination of the entertainment offered; for those with the slightest leaning towards things mechanical there was endless interest, and for everybody there was the sheer, indefinable beauty of flight executed by master hands.

(Left) The stop-butts were never neglected. A Bulldog is seen trying its Vickers guns at Hornchurch.

A batch of attendance figures received as we go to press suggests that Hornchurch, Essex, is likely to top the poll with an attendance of 14,572; Aldergrove, Belfast, gives 11,899; there were 9,564 at Hendon, 8,675 at Leuchars, and 8,414 at Henlow.

In the descriptive matter which follows no attempt has been made to report the proceedings at every one of the ninety-odd aerodromes open; to do so at all adequately would be manifestly impossible. Instead, some typical examples up and down the country have been chosen at random and dealt with in some detail.

We may begin with some general impressions gathered on Saturday afternoon by a member of the staff of *Flight* during a tour of a number of Service stations in a D.H. Rapide—actually, the erstwhile Royal G-ACTT, now the property of Olley Air Service, Ltd., who had put it at the disposal of the Air League.

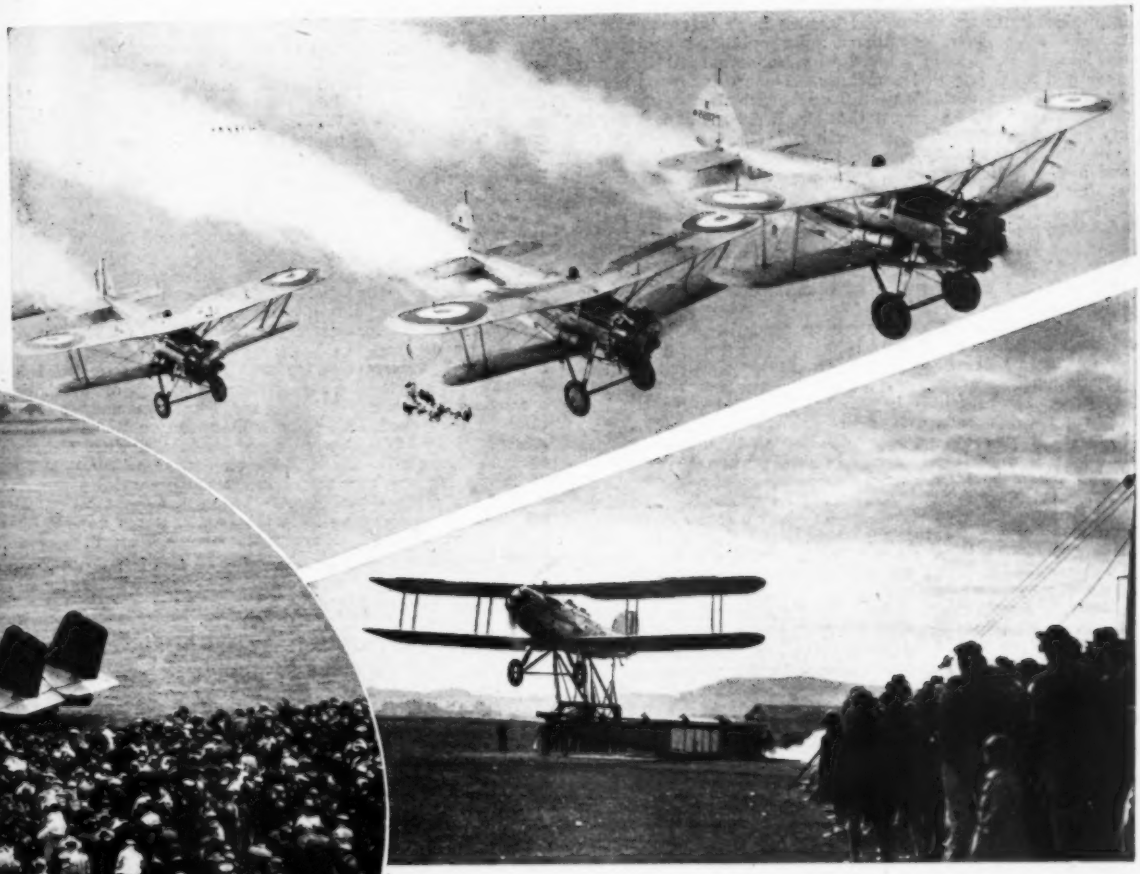
The first objective (he writes) was Henlow, in Bedfordshire. This station, when we arrived, was just shaking itself free of a drizzle and beginning to welcome a pretty solid-looking stream of visitors from its immediate vicinity and the nearby towns of Shefford, Biggleswade, Baldock and Hitchin.

In one year this station has undergone a metamorphosis. It is still known as the Home Aircraft Depot, but since the Royal Air Force expansion got under way its activities in maintaining the whole of the Service's engines and airframes have been temporarily suspended—the makers and other contractors have taken over the work—and the H.A.D. has become almost entirely a school for the training of directly enlisted "tradesmen." There are no fewer than 2,500 aircraftmen undergoing eight-month courses either as Riggers (a misleadingly narrow term in view of the scope of their work), or Flight Mechanics. The first batch of a hundred has just passed out.

A Heyford taxies out at Hornchurch for its "show."

A tour of the shops leaves one impressed but bewildered; in the whole of Britain there can be no factory—aeroplane, motor car, or anything else—with quite such an amazing variety of departments. At one end of the scale, so to speak, one saw the foundry and blacksmiths' shop, wherein cherry-red ingots were being pounded by power hammers; and at the other end lads with the eyes and fingers of watchmakers were repairing A.S.I.s and dealing daintily with the internal economy of George, the robot pilot. In between these extremes one found machine shops, pattern shops, electro-plating shops, electrical shops, engine overhaul and assembly, airframe assembly, doping, welding, laboratories, and even a wind tunnel.

Everything, from the forge to the wind tunnel, was in full



Empire Air Day in Scotland: The catapult (seen projecting a Fairey III F) provided unusual interest at Leuchars. (Top) Smoke evolutions by Bulldogs at Hornchurch.

A camera gun on a Demon at Hendon casts its spell. Similar scenes were common at some fifty other military aerodromes.

blast, literally and metaphorically, so the Air Day visitors had their moneysworth. Although the trainees were losing a Saturday afternoon's leave they must have enjoyed recompense in the questions they were asked—such as (overheard at the automatic pilot demonstrations), "And does the pilot have to have all that machinery strapped to him?"

Of the original establishment, only the Officers' Engineering Course, General Engineering Unit and Parachute Repair Section remain.

The last-named branch, as last year, contributed some of the most popular items to the flying display, which was a most ambitious effort of twenty items ranging from crazy flying in a Moth to a full-scale gas bombing attack. There was a first-rate machine park, too, containing among other things an Overstrand, complete with its cockpit greenhouses and gun turret. The flying display struck us as being something well worth seeing—a close-range, noisy, cheerful affair like the Hendon Display in the days before it became so dignified and educational—but our tour had to continue, so a course was set towards Mildenhall.

Sunshine welcomed us to this fine aerodrome, of Australia Race and Royal Review fame, with its four huge ultra-modern hangars now complete and one more under construction. One could not help feeling surprise at finding a crowd of some thousands of spectators in such a rural district as this.

Standing out like some strange islands from the sea of humanity were three of the station's gaunt, olive-painted Heyfords, their crews looking down, god-like, from the eminence of their lofty cockpits. A display was being flown-off three times during the afternoon, consisting principally of formation take-offs and landings by the Heyfords, aerobatics by a visiting flight of Gauntlets, Gauntlet *v.* Heyford battles, and message-collection by an Audax. At the time of our visit the three Gauntlets were giving a simply superb display of aerobatics, including the upward roll in flight formation.

In a hangar, open for inspection, were more Heyfords, a Hind, and half a dozen other aircraft—including a venerable Virginia, in, over and about which people were allowed to clamber, presumably so that the machine might be "reduced

to produce" (to use the official jargon) in an inexpensive and trouble-free manner. Another hangar exhibited equipment, including a dummy of lugubrious mien suspended from the roof by a fully extended parachute. There was also in action a most imposing portable neon beacon, with its own generator set, which seemed to suggest that the R.A.F. is at last catching up commercial aviation in such respects.

Anything that makes plenty of noise is a certain attraction, and a Kestrel at full throttle on the outdoor engine test-bed was no exception.

It would be a pity to leave Mildenhall without quoting this gem from the history of the station as given in the official programme: "Since then the only event of note has been the birth of 38 Squadron from the parent 99 in September last. (Progenitation amongst R.A.F. squadrons is effected by the will of diplomats.)"

And so southward once more to Hornchurch, where the whole population of Ilford, Romford and the East of the Metropolis in general appeared to have crammed itself into this very urban aerodrome. And surely no stranger collection of aeroplanes can ever have been seen at a Service station. The first sight which met our startled gaze was a *Pou-du-Ciel*, rubbing wing-tips, so to speak, with a Parnall G.P.; a Drone was consorting with a Hind, an Audax, and a Demon; and a Dagling sailplane was unabashed by the presence of a Heyford and a Virginia; an elderly Desoutter was apparently joy-riding. And that was merely a random selection; a study of the programme suggested that a search amid the throng might also have brought to light a Scion, some Moths and Bulldogs, a Tutor or two, a Cadet, an Anson, and an Autogiro; even a Short Singapore was on the list!

Apart from all this, the O/C. and his henchmen appeared to have their hands full with a very ambitious flying display, so, picking our way amid small boys, A.A. guns, searchlights and Dagenham Girl Pipers, we sought the safety of the Rapide, and Capt. Midgley, choosing the right moment between the dropping of an advertising banner from a 504 Avro and a load of bombs from a squadron of Bulldogs, took off for Eastchurch. Had we needed any assurance of the success of Empire Air Day, a visit to Hornchurch alone would have been sufficient.

Eastchurch, in the Isle of Sheppey, and many miles from any populous centre, was a haven of rest by contrast. In sunny weather, on its gently sloping hillside among the water-meadows, the Air Armament School is a pleasant spot. Its work was described in an article in *Flight* of May 14, so we will not deal with it again here; but one could not help marvelling at the thoroughness with which the general public were being shown practically every branch of the station's activities. Presumably it did keep one or two State secrets to itself, but a study of the programme certainly left one wondering what they could possibly have been. Here, with a vengeance, Mr. Taxpayer could see exactly how his money goes up in smoke—acrid cordite smoke from a Vickers gun surrounded by a delighted crowd holding out its hands to catch the ejected empties and belt links, or stannic chloride smoke from practice bombs dive-dropped from Bulldogs on an "enemy camp" on the far side of the aerodrome.

In one of the hangars could be seen a Wapiti, waggling its ailerons, elevators and rudder, apparently of its own volition—until the heads of two very small and very pleased schoolgirls popped up simultaneously from both cockpits. It seemed to typify the whole spirit of the day, both here and elsewhere—"make yourself at home."

There was time for one more call—at Biggin Hill, that odd plateau perched on the brink of a wooded Kentish valley. Here the Bulldogs of No. 32 (F.) Squadron were just being wheeled into their hangars after a display of aerobatics, quick-getaways, air fighting, ground attacks and so forth. Likewise there were Anti-Aircraft Co-operation Wallaces which returned from visits to civil aerodromes, and their elaborate equipment, such as windmill-driven drogue winches, seemed to be causing any amount of interest. The officers reported a most gratifying attendance. Undoubtedly the most successful indoor item, judging from the crowd, was a non-stop gas mask lecture by a Flight Sergeant. And so home to Croydon, where normal routine had perforce been observed all day.

AT HENDON

Impressions from an Always-popular Empire Air-day Venue

THE North Londoner, at least he who lives near Hendon, no longer bothers to pause in his gardening and gaze at R.A.F. formations. But he went along to Hendon, *en famille*, on Saturday and enjoyed the show nevertheless, because there was plenty which was not normally open to public gaze.

That same familiarity with Demons and Harts may, perhaps have prevented a true appreciation of the meritorious formation flying by nine Avro 504 Ns, substituted for the Demons of No. 604 (County of Middlesex) (Fighter) Squadron. They were superb. Unabashed by gusts and bumps this motley collection of yellow and silver veterans resolved itself into some of the most effective formations in the book.

There were two interesting "single-float jobs" to be seen at Felixstowe last Saturday. They were the Fairey S.9/30 with steam-cooled Kestrel and the Hawker Osprey. (*Flight* photographs.)

Full marks also to the pilots of the two synchronised aerobatic Harts of No. 600 (City of London) (Fighter) Squadron. They provided much of the noise which is so necessary at these affairs and as pretty and well-timed a spectacle as one can remember since the Furies at the R.A.F. Display.

A Tiger Moth from Hatfield, a Hawk from Reading, a Blackburn B.2. from Hanworth, and a Tutor from A.S.T. obliged with further aerobatics. As all except the Tutor were in the low-powered category the crowd must have felt that there was a certain sameness about the exhibitions.

Some of the craziest of crazy flying was done, at a wide throttle opening, by a Hatfield Tiger. Other exhibitions of deliberate idiocy fell to the lot of a 504 N from No. 604 Squadron, and an Aeronca which, according to the official programme, came from No. 601 (County of London) (Fighter) Squadron. Now this little error is greatly to be regretted for, like the reference to "three Hawker aircraft of the Civil Flying Training School, Reading," it must have been extremely confusing to the uninitiated.

There was to have been a mighty air battle between Nos. 600 and 601 Squadrons in conjunction with 11th London Regiment A.A. Brigade, R.A. (T.A.). The indisposition of several of the first-line machines of these units caused nine Lynx Avros to fill the breach and to become the targets for "Archie."

A demonstration by a Kestrel V Demon and a fly-past rounded off the show.

Hendon was particularly lucky, of course, because a number of the amenities for the R.A.F. Display, like stands and the new machine park, were already in existence. In place of the "new and experimentals" near the main entrance there was an exhibition of various civil and military types which included the Hart, Demon, Tiger and Hornet Moth, Spartan, and Lynx Avro.

The catering and instructional arrangements were of the usual Hendon order. That is praise enough.

CIVIL and MILITARY

A Look-in at Lympne Airport

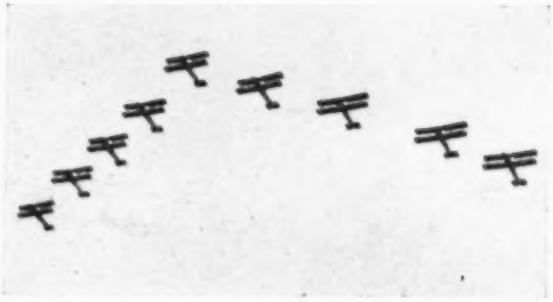
LYMPNE Airport was the scene of a really cheery party. Sunshine all day did its best to counteract an otherwise chilly nor'-easter. An interesting programme, arranged by the Cinque Ports Flying Club, was run through without a hitch. Flying Officer J. W. Deacon, from No. 2 Squadron, set the ball rolling with an exhibition of message collecting by Audax. "Supplies" were also dropped by parachute—and, incidentally, very nearly lost owing to the high wind dragging them across the ground to the boundary. Following this, the Audax, in a series of quite breath-taking dives from *circa* 8,000, deafened everyone with its whistling thunder as it pulled out just over the hangar roofs. Then the club's instructors carried out various formation movements in Moths, the display showing up to advantage when a perfectly drilled flight of fighters appeared from Hawkinge. Converging bombing, definitely crazy flying by Mr. K. K. Brown, aerobatics by Mr. A. J. S. Morris and a really amusing "Instructor and Pupil" act by Mr. Leslie Cliff, with Mr. K. K. Brown as the impossible pupil, all helped to make the afternoon go with a grand swing. In the meantime a Dragon was busy initiating members of the crowd into the delights of air travel, while the more timorous were persuaded to part with cost of a "flip" for some of the many enthusiastic children in the crowd. In this way over twenty future airmen took the air for the first time—small wonder all the youth of Hythe and Folkestone seemed to be up at Lympne the next day wearing the best line in hopeful outlooks

AT a CIVIL AERODROME

Hatfield's Attractions

AS an example of a usually busy civil aerodrome—as opposed to an airport—Hatfield was probably normal. The very extensive fleet of the London Aeroplane Club was lined up and the instructors were only fitfully busy in giving joy-rides. Various machines—temporarily including a British Airways' D.H.86—were to be seen on or near the tarmac, but a ceiling which was, on occasion, down to something like 200 feet, with intermittent fine rain, made it all the more surprising that a very fair crowd turned up, particularly since Hendon was within easy motoring distance.

However, the low ceiling did not daunt one of the Reserve School instructors, Mr. G. S. King, who put up a magnificent, not to say heart-failing, show on one of the school Tigers. He used no more than the maximum of 500 feet, and rolled off loops from ground level. But his crazy flying exhibition was the star turn of the performance. This was made all the more exciting by the fact that he put the hood down to keep off the rain and carried out his hangar-missing skid-turns while peering from beneath it. The turn concluded with an engine-on down-wind "landing" followed by a perfect novice's landing in real earnest.



Nine Avro 504 Ns put up an unusually good exhibition of formation flying at Hendon on Saturday. (*Flight* photograph.)

IN the NORTH

Some Notes from Cheshire and Yorkshire

ON the western side of Northern England Empire Air Day seemed to awaken less interest than in the South, perhaps because the populace see so few military aircraft during the year that their interest has never been whetted. No. 5 Flying Training School at Sealand, Cheshire, had its crowds, but the flying display was somewhat hampered by a very strong and gusty wind. There was more doing on the Yorkshire side, and Flt. Lt. N. C. Odbert, Adjutant of No. 609 (West Riding) (Bomber) Squadron, A.A.F., did some spectacular work at Yeadon, the Leeds-Bradford municipal airport. Big crowds visited Catterick and watched aerobatics by No. 26 (Army Co-operation) Squadron, while a Virginia attacked and was engaged by two Audax—or Audaces. Perhaps the biggest crowd—11,000—was at Thornaby, where there was everything from parachute drops to a gas bomb attack, not forgetting a Slingsby sailplane towed and cast-off by a military machine.

SETTING the STAGE

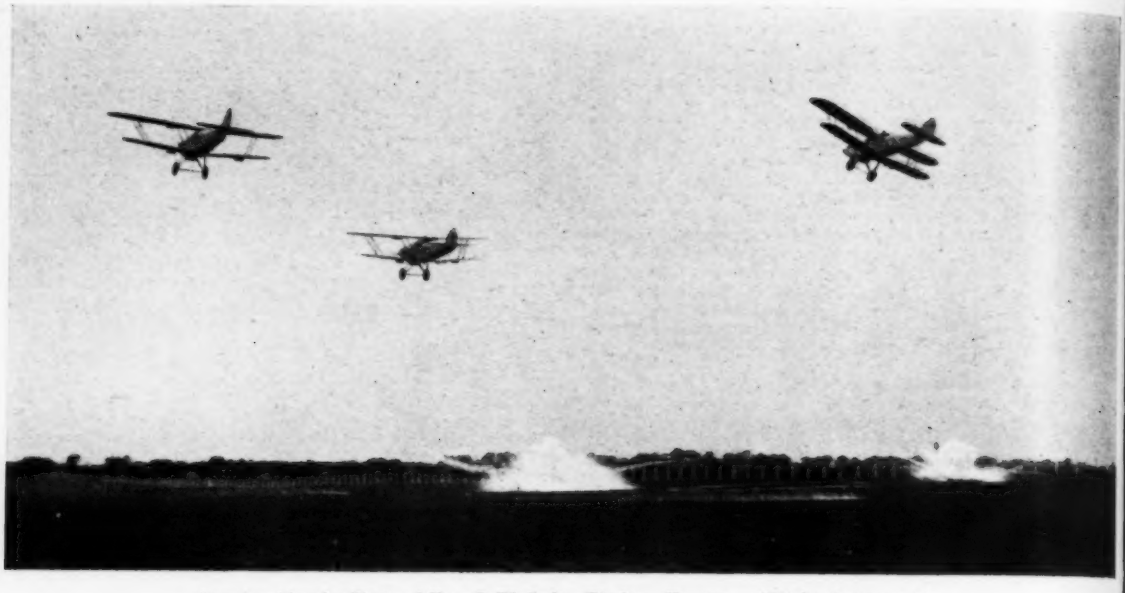
Detailed Descriptions by a Member of the Staff Who Visited Several Famous Stations on the Eve of Empire Air Day

YOU never know what aeroplanes you may see while travelling through the fire-scarred heathland round Martlesham on a fine day. A fighter may rocket-up four thousand feet a minute from behind a gorse clump. Drab "heavies" may come muttering and swishing down over the road, to settle with a self-satisfied grunt on the dusty aerodrome. The latest high-speed civil transport may glint between the clouds, flying at a speed which will never be demanded from it in service. The breeze may bear a thousand-rounds-a-minute chatter from the stop-butts. . . . That is Martlesham.

Martlesham determines the performance of every British civil and military aeroplane and item of aircraft armament, and is designated officially "The Aeroplane and Armament Experimental Establishment." The Commanding Officer is Group Captain A. C. Maund, C.B.E., D.S.O.

The word "performance" as applied to military aeroplanes is comprehensive in the extreme, embracing as it does every flying and handling characteristic. It is the work of the Martlesham pilots and technicians not only to determine speeds at all heights up to the ceiling, the rate of climb, take-off and landing runs and general flying qualities, but to report on the behaviour of the engine with its cooling system, airscrew and instruments, and of the undercarriage. The merits and disadvantages of the structure are also assessed before a machine is recommended for adoption.

The old lay conception of a test pilot dies hard. To many he is still a semi-animated Sphinx who nonchalantly flicks out



Low bombing by Harts of No. 18 (B) Sqdn., Bircham Newton. (*Flight* photograph.)

his cigarette, stalks to an untried aeroplane, crouches over the controls, clenches his jaw, and makes a jab at the throttle; up he soars, high, wide and handsome: here a loop, there a spin and there a falling leaf. A cryptic word of jargon to the hushed technicians, and the aeroplane is damned or approved.

Now what manner of man is the Martlesham pilot in real life? So far as appearance is concerned he is just any R.A.F. officer, in demeanour like his fellows, and the most obliging and sporting individual imaginable. His mind must function precisely. His hands must be sensitive. But above all his heart must be in his job. Protracted flying trials in extreme discomfort can only be made efficiently by a man who himself is keen to find the why and the wherefore. There are still some tests the results of which cannot conveniently be given in figures, so he requires the ability to express himself lucidly.

So far as one can gather the station is not surrounded by plain-clothes men with bulging hip pockets. It is possible, in fact, for any Tom, Dick, Harry, Fritz, Gaston, Benito or Elmer to feast himself from the nearby road on much of the flying. But the taxpayer can rest assured that aircraftmen are not detailed to distribute data to any wide-eyed extraneous onlooker.

The Station

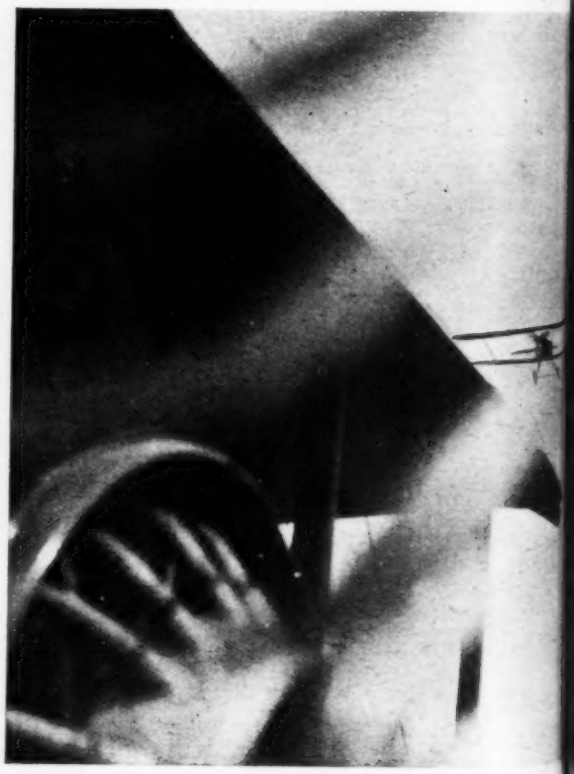
The station is divided into the Performance Testing Section and the Armament Testing Section, both of which are under the control of the Station Headquarters. The Performance Testing Section consists of three flights whose hangars are in a group at the Woodbridge end of the aerodrome. A large red hangar houses the flight which deals with large multi-engined machines, and the remaining two buildings accommodate small and medium-sized single-engined types. Farther along the main road towards Felixstowe are the armament testing hangars, the first, devoted mainly to the testing of guns, being provided with single-seater fighters and two-seaters. The second, a red one in the centre of the camp, deals with bombing tests, and contains a variety of heavy machines. Then there are buildings for the armament workshops, instrument shop, engine repair shop, and all the usual offices, messes and blocks.

As mentioned at the outset, you never know what you will see at Martlesham, so the best course to take here will be to describe something of what was there on *Flight's* pre-Empire-Air-Day visit

It happened to be at a period when there was comparatively little doing. But that is not to say there were not acres of interest. One was greeted by a tumultuous howl from the two Wasp Juniors of the Monospar *Croydon*. Another pilot was trying out the S.T.25 with twin rudders. A modification —or more correctly, an alteration—of this nature may, of course, have a pronounced effect on the handling qualities of a machine Martlesham finds out. Naturally there is close liaison between Martlesham pilots and those employed by manufacturers; Bulman, Staniland, Uwins, Schofield, Summers and the rest are frequent visitors.

The two last-named were there during our visit: Schofield, of course, in connection with the Monospars, and Summers, presumably, on some mission having bearing on the big geodetic Wellesley, in which the writer was privileged to fly.

There are features of this magnificent aeroplane about which it is not permissible to write. It may be said, however, that



This picture is notable for two reasons : the way the airscrew has photographed and the proximity of the Hawker Hector.

the engine installed at present is the Bristol Pegasus X, which will deliver 975 h.p. to a V.P. airscrew for take-off. At the moment a three-bladed Fairey is fitted. The production Wellesleys are likely to have the Pegasus XVIII supercharged engines with two-speed gear. Without having recourse to figures, the Wellesley strikes one as having the span of a Heyford, and the initial climb, when flying light, at least, of a 1930 interceptor. But that may be just the impression one gets from the gunner's cockpit. It was a revelation to sit there, surrounded by curved diagonal members and secrecy, and to watch the great wings, with the peculiar criss-cross marks, take up an incredibly steep angle as Martlesham shrunk below the tail. The Pegasus, be it said, was astonishingly smooth in spite of the fact that something like 100 h.p. was being taken from each of its nine cylinders. The agility of the Wellesley (demonstrated at 10,000 ft.) and slow, gentle landing with flaps down seemed almost as remarkable as the superlative load-carrying ability which the machine is known to possess.

Another type in which the writer flew, and which, for a machine of its class, has an outstanding performance, was the Hawker Hector—the latest army co-operation type to be adopted by the R.A.F. Although essentially one of the prolific Hart family, it has certain features which are not to be found among its relatives. Foremost among these is the Napier-Halford Dagger III engine. "Engine" seems a clumsy word for such a piece of mechanism (one cannot help thinking of *Puffing Billy*), for its twenty-four cylinders and high r.p.m. give it some of the more desirable characteristics of a dynamo. With the altimeter showing 5,000 ft. (the Dagger Mk. III as fitted to the Hector is moderately supercharged), and the tachometer indicating 4,000 r.p.m., the A.S.I. reading is in the region of 200 m.p.h.

Martlesham is all set to receive some of the new monoplanes. The Hawker fighter, of course, has already been there (one was told of the terrific reverberation felt in every building on the aerodrome when the Merlin was first opened up on the ground) and the Supermarine, also with a Merlin, should have been delivered in time to be demonstrated on Empire Air Day. The Fairey Battle, A.W. Whitley and Bristol Blenheim are all awaited.

The most modern twin-engined machine on the station the other day was the Armstrong Whitworth 23 bomber-transport monoplane which is being tested with a pair of the new Armstrong Siddeley Tiger IXs and V.P. airscrews in place of the Tiger VIs, in which form the machine is known to the public. It is said that with the original installation it was not considered advisable to attempt a full-load take-off from the manufacturers' aerodrome at Whitley but that, in its new form, the great monoplane can be flown out at maximum gross weight with impunity.

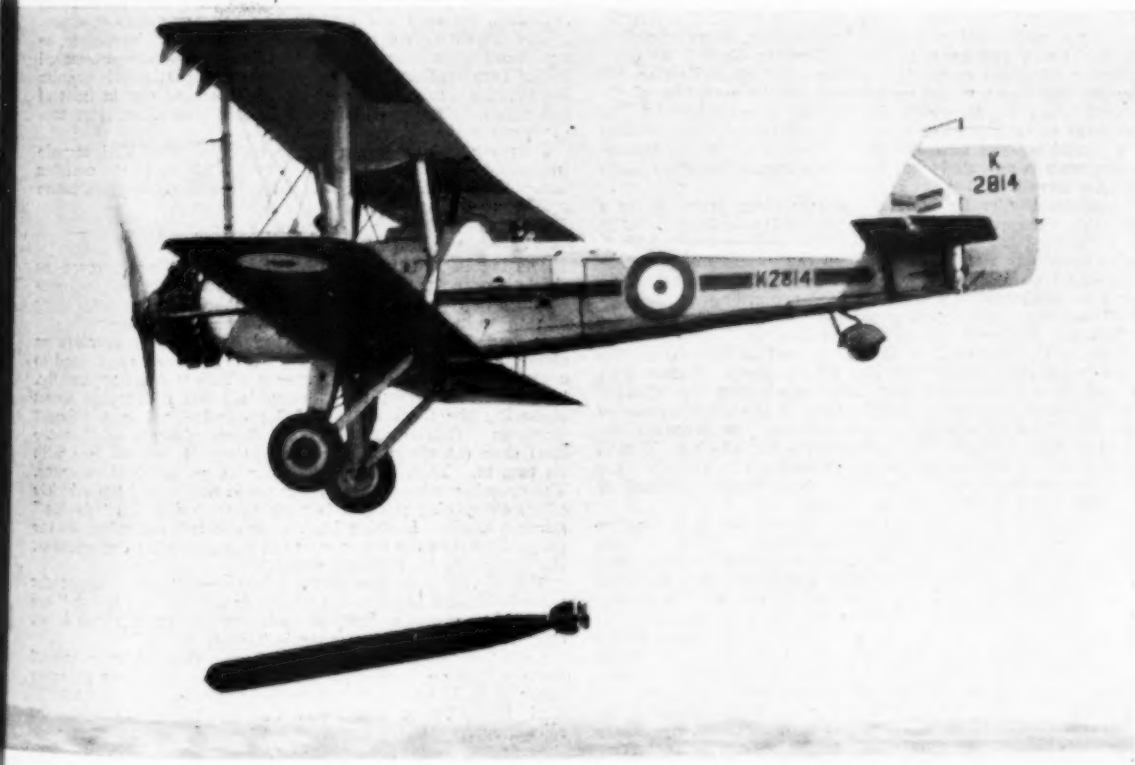
In the same hangar as the big A.W. was a Vickers Vildebeest, its Pegasus fitted with an American Curtiss electrically operated variable-pitch airscrew. The blades of this ingenious piece of mechanism are turned to the required incidence by a ¼-h.p. electric motor through a 13,400:1 planetary gear.

Armament Testing

Unfortunately, one was unable to see some of the most modern devices for improving the accuracy of gunnery and bombing. Turrets, bomb racks, releases and sights are continually being tried out. This work often entails flying at great heights and in extremely low temperatures. A gadget which may function admirably at 10,000 feet may freeze up solid at the heights to which modern military machines are able to climb. Incidentally, the lowest temperature recorded by a Martlesham pilot was at 33,000 ft., when the thermometer showed —66 deg. C.

The Armament Testing Section solves many of its bombing problems over at Orfordness, where there is a special aerodrome and instruments for measuring results.

Some miles round the coast, at Felixstowe, is the Marine Aircraft Experimental Establishment—the Martlesham for seaplanes and flying boats—commanded by Group Captain A. J. Miley, O.B.E. Machines from Felixstowe made anti-submarine patrols during the war over the North Sea and convoyed merchant ships plying between England and the Hook of Holland. To-day the duties of the M.A.E.E. are to test all new types of flying boats and float-planes intended either for civil or Service use. Apart from this, a great deal of purely experimental work is done with hulls, floats, marine



It was not possible to show the public any actual torpedo dropping at Gosport on Empire Air Day, but this picture, secured beforehand, depicts the "tinfish" a moment after its release. (*Flight* photographs.)

equipment and engines. No. 209 (Flying Boat) Squadron, now being equipped with the Short Singapore III, is also accommodated.

The Saro London and Supermarine Stranraer were away having their twin Pegasus IIIs replaced by the new Pegasus Xs, but there was the great Short R.6/28, now in the twilight of its existence, cradled in a hangar. Examples of the Perth, Southampton (one of these with a pair of steam-cooled Kestrels) and Singapore III boats were to be seen, and among the smaller fry were an Osprey and an experimental Fairey biplane with central float undercarriages, and twin-float versions of the Swordfish, Shark, Vildebeest, Seal and Ripon. The experimental Fairey is not exactly a new machine. In appearance it bears a distinct resemblance to the Swordfish, but has a steam-cooled version of the Kestrel IIMS engine with centre-section radiators. The single-float machine is suitable for catapult work but is likely to be superseded by small flying boats on the lines of the Supermarine Walrus.

A series of unusually interesting tests will be made before long with a Blackburn Perth. Vibrographs are being mounted to record the vibrations of the hull under various conditions with different airscrews and in some cases the two halves of four-bladed types will be set at various angles. Other experiments are proceeding with the measuring of hull pressures.

Twenty pressure recorders are being fitted to a flying boat hull, and will operate during landings or when the machine is dropped into the water from the great fifty-ton crane on the jetty, normally used for launching and landing purposes.

Anchors present a difficult problem. They must be light and yet possess great holding power. The standard type used at the moment has a holding force forty times its own weight.

The Heavies

The next station we called on during our pre-Empire-Air-Day tour was Mildenhall, far-famed even before it was completed, as the starting point for the England-Australia Race. It has grown since those chilly, hectic, pre-Race days when for a little while it was the one great aerodrome in the world. Now it is the home of two heavy bomber squadrons—Nos. 99 and 38—both of which are armed with the Kestrel-engined Handley Page Heyford. Actually the latter unit is an offshoot of No. 99 Squadron, and is now receiving the final Heyfords to bring it up to full strength. Incidentally, these machines are of the new Service type with full-power Kestrel VI's.

One of the most instructive of the Mildenhall Empire Air Day exhibits was a model to demonstrate the operation of the automatic pilots with which the Heyfords are equipped. The apparatus was mounted on a test bed and through the medium of a model showed how the rudder moves when the course-change cock is operated, and how the elevator functions when the trim lever is pulled back.

Squadron Leader De Lade Dropp was being prepared for a parachute descent. Formation flying by Heyfords, aerobatics by a Gauntlet borrowed from Duxford, and message-picking-up by an Audax were other items on the programme.

Having seen "heavies" at home (unluckily there was no flying at Mildenhall on that particular morning as "night-ops." had been in progress just before) we pushed northward to Bircham Newton—a light bomber station.

The units there are Nos. 18, 21, 34 and 48 Squadrons, the latter being the "baby" of No. 18 Squadron. Before long all will have been completely re-equipped with the Hawker Hind. There is pleasant anticipation of the performance of this, our new Service-type light bomber, for whereas the Harts used at present are powered with the 480 h.p. Kestrel IB engine which maintains its power only up to 3,000 ft., the Hind is provided with the fully supercharged Kestrel V normally rated at 600 h.p. at 11 000ft.

Three varieties of bombing are practised by light bomber units, these being designated, respectively, "dive," "precision," and "low." Dive bombing is normally done from about 12,000 ft. and from an echelon formation, each machine, in turn, half-rolling off the line and diving at the target. Bombs are dropped from about 2,000 ft., and speeds up to 340 m.p.h. may be attained by the Hinds. The actual tactics vary considerably with the condition of the sky, for clouds can be used as a screen. It is a favourite method of attack against warships, so for over-water work the machines are equipped with flotation gear in case of a forced descent.

Precision bombing entails flying at high altitudes, frequently by formations, and the low attack, in which very small bombs are used, is employed against troops, transport columns, and targets which do not demand the demolition of very large objects. The machines operate either singly or in formation, depending on the size and nature of the target. A 22ft. circle painted on the aerodrome provides for low bombing practice. To assist in keeping a machine at its proper angle during a dive bombing attack (this is normally about sixty degrees) a white disc mounted on a 70-foot mast is centred by the pilot in a 40-foot circle on the aerodrome.

A flight of Harts of No. 18 Squadron was to practice low bombing when we called, and the writer was lucky to be able to fly in one. The clouds were at 500 ft., and a particularly disturbing wind swept down the aerodrome. The tightness and accuracy of the formation told of superb team work. To save time after each run up to the target the flight leader took the machines round the aerodrome boundary in low, steep turns which meant that from our machine—the inside one—it was possible to obtain a magnificent close-up of birds' nests and to conduct a first-hand study of chimney-pot design. The bombs are usually dropped, singly or in salvo, when travelling at about 130 m.p.h., although in war-time the speed would depend on a number of factors.

A Set Piece

Judging from the programme which had been arranged visitors on May 23 had their full shillingsworth. The items included dive and low bombing, aerobatics by a Fury of No. 25 Squadron, a combat between two Hinds and a Heyford (the Hind is very closely related to the Demon two-seater fighter), crazy and inverted flying by Tutors from Wittering, and the demolition of a desert fortress complete with anti-aircraft armament.

The final trip of our tour was to Gosport, the home of certain Fleet Air units when they are ashore, a Training Squadron, the Coast Defence Development Unit, and a Torpedo Section. The C.O. is Group Captain W. C. Hicks, A.F.C. The folk round Gosport can always expect a first-class show on Empire Air Day, for full use is made of the unusually interesting selection of aircraft types on the station. On the day of our visit these included the Shark, Vildebeest, Swordfish, Baffin, Nimrod, Osprey, Seal, IIIF, 504 N, and Tutor. Naturally interest tends to centre round the torpedo-dropping activities, for very few units in this country are so equipped.

The attack with a torpedo is far from a dull procedure, as one found when allowed to fly in a Vickers Vildebeest attached to the Torpedo Section. The Vildebeest is particularly popular for torpedo work because the pilot is seated out in front of the wings, where his outlook is better than from more conventional types.

Instructions were given for a 1,425-lb. Mk. VIII torpedo (naturally with dummy head) to be loaded on to the crutches beneath the fuselage. It was set to run for 500 yards before coming to the surface.

A Mere Bagatelle

The big Pegasus made no bones about getting its seven- or eight-thousand-pound load off the ground and, judging from the rate of climb to 6,000 ft. over Stoke's Bay, a little thing like an 18-in. torpedo does not hamper the Vildebeest.

It had been arranged that the drop should simulate as closely as possible an actual attack. The dive was planned to confuse enemy anti-aircraft gunners. This is done, apparently, by making it as erratic as possible. After dropping about 2,000 ft., the machine is pulled up and dived in a different direction. This is repeated at a lower altitude so that the final dive (at about 220 m.p.h.) brings it face to face with its targets. Then it is held steady at 30 feet and 90 knots. The drop is made at about 1,000 yards range, and immediately after, everything possible is done to confound the "Archie" gunners again. Looking back over the tail the splash as the projectile enters the water seems to reach up after the machine; the track can be followed easily.

H.M.S. *Curacao* frequently offers herself as a target for torpedo-bomber units of the Fleet Air arm. The "tinfish" are adjusted to run at a depth of 22 ft., and as the *Curacao* draws only 16 ft. of water everyone is happy.

Unfortunately, it was impossible for the public to see all these things on Empire Day; but they did see, as at every other R.A.F. station which was open, the utmost possible. And that, be it said, was enough to satisfy even the schoolboys.

THE FOUR WINDS

ITEMS OF INTEREST FROM ALL QUARTERS

THE LOW-DOWN: The first flying picture of the new ultra-light Perman monoplane described in *Flight* last week. A Permanised Ford engine is fitted. (*Flight* photograph.)

GAUNTLETS of No. 19 (F.) Squadron will do individual acrobatics at the R.A.F. Display.

An unnamed government has ordered 31 Vultee attack-bombers.

The rarest bloom at the Chelsea Show is a new species of orchid named after Mrs. Mollison.

The De Havilland Aircraft Co. has received an order for a Hornet Moth for the personal use of Lord Londonderry.

The flap of the latest Northrop attack machine is perforated with large holes to reduce buffeting.

During 1934 23,775 persons were employed in the production of aircraft, against 20,401 in 1933.

Mr. C. M. C. Turner, the forty-six-year-old gliding expert, left Croydon on Monday in a five-year-old Puss Moth to fly to the Cape.

Flt. Lt. "Tommy" Rose has been presented with a silver casket by the people of Reading to commemorate his record Cape flight.

A Miles Peregrine has been entered for the Paris-Saigon-Paris race next October, by Mr. Bateman Scott. The pilots are to be Flt. Lt. H. R. A. Edwards and Sqd. Ldr. B. S. Thynne.

Twenty-five Years Ago

From "Flight" of May 27, 1911.

"At last our leviathan of the air has emerged from the interior of its hiding place into the full light of day. With the issues of Monday's evening papers the launch was announced, and with the Tuesday morning papers the British public realised all in a moment its full possession of the object of its desires—an immense dirigible. And it *is* an immense dirigible too, indeed the largest in existence. Over 170 yards long, no less than 16 yards in diameter."

Work for Woodford

In addition to the thirty Tutors about to be delivered to Greece, A. V. Roe and Co., have received an order for nine 626s from the same source. Austria has ordered three machines of the latter type; Finland is to be supplied with a dual-control Anson; and thirty-eight Ansons are to be built for Australia. The latter are likely to be fitted with Siddeley Cheetah IX engines, as are those being issued to the General Reconnaissance Squadrons of the R.A.F.

The D.H. Albatross

At a gross weight of 25,000 lb., the D.H. Albatross monoplanes ordered by the Air Ministry for experimental trans-atlantic flying will have a maximum speed of about 250 m.p.h.

Amelia's Electra

The Amelia Earheart Fund for Aeronautical Research has ordered a special long-range Lockheed Electra. It will be fitted with two "H" type Wasps of 550 h.p., and will have a cruising range of over 4,500 miles. A Sperry automatic pilot, de-icers, and a complete wireless equipment are specified.

Without Comment

News item received last week: "If the method reported as adopted by an American firm in Chicago becomes general it looks as if 'lift, please' will be a thing of the past. This firm has inaugurated a flying flea service to the 22nd storey of a skyscraper. The machine rises nearly vertically from a platform in front of the building and lands visitors on a platform on the 22nd storey. The service is shortly to be extended to other and higher buildings."

Forthcoming Events

May 15-June 1. Stockholm Aero Show.
May 27-June 4. Austrian Aero Club: Whitsun Tour.
May 29-June 2. Swiss Aero Club: Whitsun Tour.
May 30-June 1. Isle of Man Air Races.
May 30-June 1. Aero Club de Provence: Marseilles Week-end.
May 30-June 2. Yorkshire Gliding Club. Open Meeting and Competitions.
June 6. Official Opening of Gatwick Airport.
June 6-14. Czechoslovakia Aero Club Tour.
June 7. London Air Park Club: Hanworth Garden Party.
June 13-14. Opening of Brighton, Hove and Worthing Airport: International Rally.
June 27. Royal Air Force Display, Hendon.
July 2-5. Belgian Aviation Clubs: Tour Aerien Belgique.
July 10 and 11. R.Ae.C.: King's Cup Race.
July 18. Portsmouth Aero Club: Isle of Wight Race.
July 23-26. R.Ae.C.: Week-end Aerien.
August 1. Cinque Ports Club: Folkestone Trophy Race.
August 1-3. Yorkshire Gliding Club: Open Meeting.
August 2-15. Yorkshire Gliding Club: Instruction Camp.
August 3. Ramsgate Airport: *Pou-du-Ciel* Race.
August 8. Reading Aero Club: Northesk Cup Competition for Women Pilots.
August 15-30. Yorkshire Gliding Club Open Meeting and Competitions.
August 22. Midland Aero Club: "At Home" and Contact Air Race.
August 29-30. Cinque Ports Club: International Rally and Wakefield Cup Race.
August 29-Sept. 6. British Gliding Association: Annual Competition Gt. Hucklow, Derbyshire.
August 30. Gordon Bennett Balloon Race, Poland.
September 5-6. Aero Club of Hungary: Week-end Aerien.
September 12. London Aeroplane Club: Hatfield Garden Party.
September 13. Aero Club de France: Coupe Deutsch Race.
September 20. London Air Park Club: Display.
October 25. Aero Club de France: Saigon Race.
November 13-29. Fifteenth International Aero Exhibition, Paris.

Private Flying

Topics of the Day

Purely Civil

THE more aeroplanes a pilot flies the more certain does he become that each and all have their own particular attractions and that it is both useless and unfair to attempt criticism. Every light or medium-light machine is the result of a designer's honest efforts to produce a compromise between the ideal and the reality, and the only fair remark that may be made is that the Service temperament is too often mirrored in the type of machine which one is forced to fly.

When machines are designed both for and by civil pilots we may approach a little closer to an ultimate ideal, and of all the available machines there can be none which are so divorced from the Service bond as the B.A. Swallow. After something like a year's unfortunate absence from the cockpit of this interesting little machine I spent an hour in it last week and could not but feel that here we have something very different.

In it one does not so much fly as float, yet the cruising speed is high enough for most purposes, and the machine will do almost exactly what it is told to do if one feels aerobatically inclined. I eventually discarded both helmet and goggles—the screens are what screens in open machines should be—and it is a long time since I appreciated flying to such an extent. Viewed through goggles or cabin windows there is always a certain unreality about the outside world.

Throttled back, the Swallow could be floated about at a cool altitude with the most delightful inconsequence, and the only moment at which I regretted the lack of goggles was that when some person walked across the part of the aerodrome on which I proposed to put down. As it was impossible to see distinctly through two superimposed screens it was necessary to indulge in a crab sideslip while watching the pedestrian's peregrinations.

Safety First

HAVING been, from the Swallow point of view, badly brought up, I regretted an inability to lose height in a man-size sideslip without gaining an impressive supply of unwanted speed—until I remembered that an approach could be adjusted satisfactorily on speed alone. If the machine is slowed right up the sink is considerable, and this is one of the very few machines in which it is safe to hold the stick right back until the very last phase of the approach. There was a strongish wind blowing on this particular day, and it was not safe to take such liberties too near to ground level—even though liberties on some machines are normalities on the Swallow.

At a very safe height I had already done my best to make the machine spin and had succeeded in producing nothing more terrifying than a steep spiral. Near the ground this would, of course, break the machine fairly thoroughly, but it is doubtful if the most careless pilot would do more than bruise himself. To produce this spiral it was necessary to hold the stick right back and to give full rudder—and who would do that near the ground? Without the application of a lot of rudder the Swallow would simply sink violently into the earth, and given a really magnificent undercarriage with yards of movement might even stand this shock with equanimity.

Why not a side-by-side seater Swallow?

The Pusher Again

ON the same day, curiously enough, I had a good look round Lord Apsley's S.M.1, which, it will probably be remembered, is something of an oversize Drone and cruises at 75 m.p.h. with a 60 h.p. Hirth engine. It was first described in *Flight* in May, 1933. The view in all directions is just what one would expect, and there is no reason why such a machine, with cantilever wing, flaps, a little cleaning-up, and a rather more powerful engine should not do everything that an owner requires.

With no slipstream to worry the pilot there is no earthly need for a cabin roof, and side-by-side seating should not spoil the performance to any extent. It would be difficult to imagine a more pleasant machine for the use of any owner who has not been assailed too thoroughly by the desire to travel from A to B in the shortest possible time, regardless of pleasure.

People occasionally ask, "Why all this fuss about the pusher aeroplane?" and I can only ask them to go for a ride in the Drone and discover what real flying can be. Why, in Heaven's name, *must* we suffer a nasty, noisy and often smelly engine just in the very place where good visibility is desirable? Why should we need to choose between being blown to smithereens by a slipstream or being cooked alive in a cabin?

A Vital Point

LAST week I was just about to open up for the take-off with a medium-sized machine when my co-pilot noticed that the fuel tap had been turned off by the pilot who had just brought it in. By such stupid omissions are otherwise careful pilots killed.

At the majority of clubs and schools it is the rule always to leave the petrol tap open so that the amateur does not develop the habit of glancing thereat, and I can think of one machine which I have flown for five or six hours without even knowing quite where the tap is. In future I shall look.

Anyway, all machines should be fitted with some device whereby it will be impossible to open the throttle unless the fuel tap is in the "on" position. INDICATOR.

FROM the CLUBS

Events and Activity at the Clubs and Schools

READING

THREE Hawk Trainers and a Sparrow Hawk gave a demonstration on Empire Air Day. Mr. Malin has gone solo after only 5 hr. 20 min. dual. Capt. Campbell Black, Miss Florence Desmond and Mr. Leslie Hutchinson were amongst the visitors last week, during which flying time was thirty-one hours.

WITNEY AND OXFORD

For the week ending May 16 flying time was twenty-eight hours. Mr. G. W. Phillips became a pilot member.

BRISTOL AND WESSEX

New pilot members include Messrs. J. Hobhouse, Lewis and Radford. Last week's flying time was 49 hr. 10 min.

LEEMING

Everyone was busy on Empire Air Day. Flying time for the month to May 23 totalled 103 hr. 45 min. The Monospar has been demonstrated by Mr. Seth-Smith.

C. A. S. C.

On Empire Air Day members were on duty at Hatfield, Heston and Hanworth. The flying times for Sunday were 3 hr. 35 min. dual and 3 hr. 20 min. solo.

NORFOLK AND NORWICH

Thirty-four hours' flying was recorded last week. Messrs. H. A. Chandley and R. A. Gunton became members. Mr. E. L. Pearce has gone solo.

BENGAL

On account of the severe heat in Calcutta many of the flying members have left for cooler parts and consequently there is a fall in the flying time. Actually the figures are 16 hr. 50 min. dual and 36 hr. 35 min. solo.

LONDON

Although on two days weather conditions were unfavourable to flying, 124 hr. 30 min. flying was put in last week. Messrs. G. Russell Hay and J. B. Woolley completed the tests for their "A" licences and Mr. L. T. Harris went solo. Messrs. C. R. Beverley, A. G. C. Corbin and K. E. Buxton made their night flights. Visitors included Mr. and Mrs. J. A. Mollison and Miss Jean Batten.

CAMBRIDGE

First solos have been made by Messrs. Tolson, Massey, Luddington, Gotch and Dixon-Spain. New members included Miss Harding and Messrs. Hignett, Warrington, Lingford. Messrs. Abbot and Tolson have passed their "A" licence tests and Mr. Wallace, who recently joined, is qualifying for his "B" licence. Flying times at Marshall's Flying School, Ltd., for the week ending May 23 totalled 126 hours.

HANWORTH

The weather for Empire Air Day left much to be desired, but in spite of a cold wind and the bleak outlook the aerodrome was visited by large crowds. Mr. N. M. Gibbins, one of the oldest members, is housing his Gipsy II Moth in the Club hangar. New members are Mrs. G. Bingham and Messrs. V. Frizzoni, H. A. Stokes, and Lt. Cdr. D. B. Wyburd. Last week's flying time was 42 hr. 30 min.

BORDER

Very little elementary solo flying was possible last week owing to rough weather. Two club machines flew to Dublin on the invitation of the Irish Aero Club. The aerodrome of the Border Club is situated on the main Carlisle-Glasgow-Edinburgh road and large numbers of motorists stopped for a joyride in the B.A. Eagle. Blackpool and West Coast Air Services resumed their Carlisle service from May 18.

SOUTHEND

The month's landing competition was held on Sunday, May 17, and was won by Mr. Cutts, who was 66 ft. from the mark. Flying time exceeded forty hours. During the week-end Mr. C. F. Cotton took his "A" licence, Mr. F. W. Phillips went solo, and Mr. and Mrs. Scrutton, Miss Carr, and Messrs. Durell, Gooding and Williams became pupils.

TOLLERTON

Flying times at Tollerton for the weeks ending May 14 and May 21 were 41 hr. 45 min. and 33 hr. 45 min. respectively. Mr. F. Nash has gone solo. New flying members are Miss R. Bradshaw and Messrs. B. H. Dowson, J. D. Bradbury, J. D. A. Rogers, R. H. Crisp, and new associate members are Mrs. I. Pond, Miss G. Sharp, Messrs. G. Kenning, E. A. Longstaff, A. La Touche Darley, R. A. Smith, L. J. Belcher, E. J. Shopland, D. Morkel and L. H. Colton. on Saturday, May 16, about 70,000 saw Clem Sohn make his descent. There were twenty-five visiting aircraft for the event.

ROMFORD

The Drone Flying Club, which is now known as the Ultra-Light Aero Club, has moved to a bigger and better aerodrome at East Horndon, on the Southend arterial road. An opening air display will be held on Whit Sunday.

REDHILL

The Blackburn Segrave is popular with embryo "B" licence pupils. There are seven new members. Four members are taking their blind-flying courses. For the week ending Friday May 22, flying time was 74 hr. 55 min.

YORKSHIRE

Club machines flew 57 hr. 40 min. last week. Mrs. M. L. Brown and Mr. J. Davy passed their "A" licence tests and Mr. A. Douglas went solo. Miss Winifred Edwards and Messrs. Walker and Ponton have become members. The Zeppelin *Hindenburg* passed unexpectedly over the aerodrome on May 22. Empire Air Day attracted huge crowds.

PORTSMOUTH

A "dawn patrol" is being held on Sunday, June 14, between 8.30 and 9 a.m. No landing fees will be charged during this patrol. Last week's flying time amounted to twenty-six hours. High winds prevented operations on two days. New members are Sub.-Lt. H. D. Mathew, R.N., Sub.-Lt. G. E. Lake, R.N., Messrs. J. H. Williams, R. M. Phillips, Capt. Pat Murdoch, Messrs. D. A. Letts and D. C. Brown.

HESTON

Three Airwork pupils made their first solo flights on Tuesday, May 19. They were Mr. E. R. B. Asprey, Mr. L. D. Darrell, and Mr. A. J. Cooke. The latter had his first lesson on Thursday, the 14th, and flew solo on the following Tuesday. Only strong winds prevented him from completing his licence tests the next day. A pupil who attends less regularly, but is making good progress, is Prince Suprabhat Chirasakti of Siam. He is the brother-in-law of the ex-King of Siam.

CINQUE PORTS

The Empire Air Day happenings at Lympne are reported on another page. A number of distinguished people visited the airport last week, including King Leopold of the Belgians, Miss Jean Batten—who was flying out to Barcelona to bring back her mother—and Mr. Ken Waller in his already famous Caudron. New members included Messrs. R. L. Nunn, G. F. H. B. Dickson, M. S. Balmain, Capt. S. H. Cox, C. J. Porteous, D. O. Wolson, and B. C. de Muralt. Capt. Harold Finch took his "A" licence. Flying time for the week was seventy-four hours.

SOUTH COAST

Arrangements for the International Meeting on June 13 and 14 are nearly complete. Besides the race and displays on Saturday and Sunday afternoons, it is hoped to arrange a dinner dance at the Grand Hotel on Saturday night and at Warnes Hotel, Worthing, on Sunday night. Visitors will be welcome and reservations can be made on application to the secretary. A very large crowd came for the Empire Air Day show and the R.A.F. from Tangmere put up a wonderful performance. In spite of bad weather and high winds during the first part of the week just on forty hours' flying was recorded.

HERTS AND ESSEX

Although two machines have been in the shops for overhaul, 189 hr. 52 min. flying was logged during the fortnight ending May 21. First solos were made by Messrs. R. O'Donnell, J. W. H. Beken, D. A. Cather and M. V. Laurie. The two last have also completed their "A" licence tests. Mr. Sig. Rendall has made the night flight from Croydon to Lympne. New members are Messrs. J. H. Simpson, D. A. Cather, V. M. Morris, W. Hay Hicks, A. H. Swann, C. Eldon Potter, C. R. Walters, H. J. Crawford, B. F. Kilian, and L. Molyneux. A new private owner is Mr. V. A. Ercolani, who has acquired a Sports Avian.

BROOKLANDS

Flying times are well up to average. Messrs. Lovell Rasmussen, E. G. Roberts, P. Randolph and B. Heber Percy have become members. Miss Young and Mr. Dence have completed the tests for the "A" licence and Messrs. Aitchinson and Lloyd have taken a course of instrument flying. Of the four candidates who sat for their Second Class Navigators' examination, Mr. G. Bembridge and Mr. M. F. Attwell passed in all subjects, while Mr. J. Valetta failed in "Met." only, and Mr. J. Bernard Smith failed in signalling only. The Sales Department has sold a Gipsy-Comper Swift to Mr. Richardson and a Fox-Moth to Giroux of Southport. The Tipsy visited the aerodrome on Saturday. The week's big event was Ken Waller's delivery flight of the 1912 Caudron, of which "Ken" writes on another page of this issue.

FLYING a MUSEUM PIECE

Mr. Ken Waller Tells the Story of His Journey, Last Week, from Brussels to Brooklands in a 1912 Caudron

WHEN I was in Belgium in 1931 I was very much struck by the performance of a 1912 G.3 Caudron (90 h.p. ten-cylinder Anzani radial) flown by the owner, M. J. E. Ledure, at the International Rally at Le Zoute. Having already met M. Ledure at Brussels, I did my best to persuade him to sell me the machine as a curio, but he told me that he wished to keep it for a year or so, after which he had promised it to a museum. Since then I have met him several times and have always enquired about his Caudron. About two months ago he wrote to me and offered to let me fly it over to this country and show it to the many friends whom I knew would be very much interested in seeing an "old-timer" which could still really do its stuff.

On Wednesday of last week Capt. Max Findlay, sales manager to Brooklands Aviation, Ltd., and myself flew over to Brussels in one of the School Moths to collect OO-ELA, the Caudron. After a certain amount of delay owing to leak in the petrol gauge, I took off with her at about 13.30 hours, making for Ostend, where we had to clear Customs.

The journey to Ostend took about 1¼ hours, and as we approached the coast the wind strengthened considerably, gusting up to about 45 m.p.h. I expected to have quite a lot of difficulty in landing in such a strong wind, but was agreeably surprised at the manner in which the controls answered in such very rough conditions.

Meanwhile, Capt. Findlay had been escorting me very closely in the Moth and heroically throttling back to keep up with my maximum velocity of 53 m.p.h.! We arranged at Ostend that in order that I might keep what little height I had attained by then, only the Moth should circle Calais.

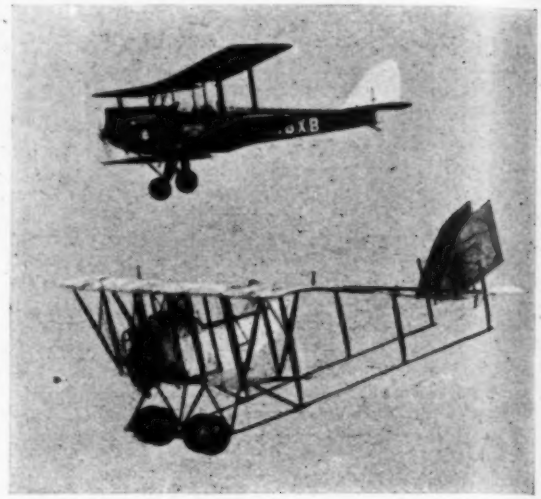
Above the Clouds

After Dunkirk I was flying above cloud of the 10/10ths variety, and when I judged I was over Calais I altered my course (with the aid of only a pocket compass) to cross the Channel. Meanwhile Capt. Findlay signed to me that he was going down to circle the signal station at Calais and give the necessary signals, then disappeared through the clouds and left me alone in my glory.

I expected to see him return after about ten minutes, but continued for another thirty minutes without a sign of him. I began to think that I must be on any course but one that would bring me over England. However, with the aid of my pocket compass I found I was still steering a northerly course and allowing for a considerable amount of drift, which I judged should be about right.

After another lengthy fifteen minutes, I was delighted—and, I may say, very much relieved, to see the Moth tearing down on me from a very great altitude.

I learned later that Capt. Findlay, after signalling Calais, had come back through the clouds. He could not spot me anywhere, so he climbed up to about 8,000 feet in the hope that at that height he might pick me out against the background.



The Caudron and the Moth in close company. Note Mr. Waller's perch at the extreme rear of the nacelle.

A few minutes after we had joined up again I spotted a break in the clouds, recognised the familiar sight of Folkestone's stone pier immediately below, and lost no time in diving through the gap and making for Lympne.

The clouds were down to about 600 feet and the wind was gusting up to about 50 m.p.h. when I spotted the aerodrome. Having got about 500 yards down-wind from it, I started to make my approach, but was somewhat disconcerted to find that at the ordinary cruising revs (1,100) I was steadily losing ground. However, I gave her full throttle (1,200 revs) and duly started to go slowly ahead.

My approach must have taken at least 12 to 15 minutes, giving, I believe, several well-known directors and others attacks of heart failure! However, I eventually touched down, and many willing hands ran out and held me on the ground while I was still going at full throttle. This part of the journey from Ostend to Lympne took me 1 hour 40 minutes.

After waiting at Lympne for about an hour the wind dropped a bit, and I decided to get home to Brooklands, where I arrived at about 20.10 hours, having taken 1 hour 35 minutes for the journey. On this last lap I was so perished with cold, flying at 2,000 feet, I several times came down to 1,000 feet; but, receiving the most atrocious bumps at this height, I thought discretion the better part of valour and, cold or no cold, quickly scrambled back to 2,000, which I decided was the safest height until such time I could see Brooklands.

TWENTY SINGLE-FEE KING'S CUP ENTRIES

TWENTY entries had been received by the time the lists for the King's Cup Race closed at ordinary fees last week.

Some interesting names of entrants and machines appear in the list given on this page. It will be noticed that H.R.H. the Duke of Kent has again entered the Percival Mew Gull, which, in the hands of Capt. E. W. Percival, made the fastest lap of last year's race at 211.178 m.p.h. Another notable entry is that of a Percival machine, type unstated, by Lieut. Misri Chand, who, in a Moth, won the recent Viceroy's Cup race in India.

Among noteworthy machines, two examples of the new B.A. Double Eagle—entered as the B.A.4—will make their first public appearance, while the "twin" class is also supported by a D. H. Dragonfly and the new Miles Peregrine. Incidentally, it looks as though the Dragonfly may be the sole representative of the biplane class.

Entries close finally next Saturday, May 30. The race takes place on July 10 and 11, with Hatfield as headquarters.

Entrant	*Aircraft*
H.R.H. The Duke of Kent ...	Percival Mew Gull
Viscount Wakefield	T.K.2
The Viscountess Wakefield ...	Miles Hawk
W. Lindsay Everard, M.P. ...	Percival Vega Gull
Lord Willoughby de Broke ...	B.A.4
Sir Charles Rose, Bart.	Percival Vega Gull
Capt. G. de Havilland	D.H. Dragonfly
W. A. Phillips	B.A. Eagle
Lt. P. Randolph	Percival Vega Gull
P. H. Maxwell	Miles Sparrow Hawk
J. H. G. McArthur	Miles Sparrow Hawk
Bateman Scott	Miles Peregrine
J. M. Bickerton	Miles Hawk
Capt. W. L. Hope	Gipsy Comper
Mrs. Elise Battye	Miles Hawk Major
Wm. Humble	Miles Hawk
Charles Best	B.A.4
Lady Joan Hoare	Miles Hawk
Sir Connop Guthrie, Bart. ...	Percival Vega Gull
Lt. D. Misri Chand	Percival

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AIRCRAFT PERFORMANCE IN NON-STANDARD ATMOSPHERE

The Effect of Varying Atmospheric Conditions May Usually be Disregarded in Performance Estimates, but in some Special Cases it May become Very Important

By Lt.-Col. J. D. BLYTH, O.B.E., A.F.R.Ae.S., M. I.Ae.E.

IN the course of the design of any form of power-driven craft it is usual, at some period during the proceedings, to make an estimate of the performance of the craft in question. In the case of a ship the calculations are simplified by the fact that, for all practical purposes, the density of water is constant; but in the case of an aeroplane considerable complications are added by the fact the craft depends for its support upon a medium whose characteristics not only vary with the altitude but also can, and do, alter continually at any given height.

It is plainly impracticable to make performance estimates to cover all possible atmospheric conditions at every height, since such a course would involve an infinite number of calculations; and to obviate the confusion which would arise if every individual or group of individuals were to refer their calculations and measurements to an atmosphere defined by a set of constants selected by themselves, an international standard atmosphere has been adopted. This standard atmosphere has been defined completely by assigning the values 760 mm., 15° C., and 0.002378 slugs/ft.^{3} to the pressure, temperature, and density respectively at zero altitude, and by the assumptions that air is a perfect gas, obeying Boyle's and Charles' laws, that the value of gravity is not affected by altitude, and that the temperature gradient is $-1.98°$ C. per 1,000 feet up to the lower limit of the Isothermal atmosphere. It is to the conditions obtaining in the standard atmosphere so defined that performance estimates are referred and flight test data reduced for purposes of comparison.

At any point in so rigidly defined an atmosphere it is necessary to know only one of the constants H (height), P (pressure), T (temperature), or ρ (density) for the determination of the value of either or all of the three remaining so that the value of H may be determined from the value of either P, T, or ρ. If to each value of H so determined a name is given indicating the means of determination it will be seen that in standard atmosphere the "tape-line" height, the "pressure" height, the "temperature" height and the "density" height are all equal. Use is made of this fixed relationship in the calibration of the standard aneroid, an instrument sensitive to changes in atmospheric pressure but calibrated to read altitudes. The calibrations are so arranged that when an altitude of, say, 10,000 feet is recorded the actual meaning is "The pressure is now equal to the pressure at 10,000 feet in standard atmosphere." It does not mean that the tape-line height and the density height are, of necessity, also 10,000 feet, since they may in point of fact be widely divergent.

Imagine the case of an aeroplane flying at a height of 10,000 feet in standard atmosphere, so that the aneroid reads the true tape-line height. Approaching a storm centre the barometer falls one inch, while the temperature rises 10° C. The atmosphere is no longer standard, and if by some means the pilot maintains his tape-line height of 10,000 feet, the aneroid reading will show a pressure height of over 11,000 feet, while the density height, in round figures, will be 12,500 feet. If, on the other hand, the pilot maintains his aneroid height of 10,000 feet, the density height will be about 11,500 feet, and the tape-line height rather less than 9,000 feet.

It will be seen, therefore, that the actual air performance of a machine at a given height may be actually inferior to its estimated performance at a greater height in standard atmosphere; not on account of any inaccuracy in making the estimate, but owing to the effect of varying atmospheric conditions. In the majority of cases the effect may

be neglected, but in some cases it is important and must be considered, as, for instance, in that of a heavily loaded machine required for flight over mountainous districts in the tropics.

From the basic equations

$$\text{Lift} = SV^2 . k_l . \rho\sigma$$

and

$$\text{Drag} = SV^2 k_d . \rho\sigma$$

it will be seen that for any given altitude of the machine the speed and thrust horse-power required vary inversely as the square root of σ, the relative density of the air.

The torque horsepower absorbed by the airscrew is also affected by the density, and varies directly as σ, as is shown by the equation

$$Q = n^2 D^5 k_q \rho\sigma$$

In this equation the term Q includes a figure for the value of the brake horsepower given out by the engine, since it must be equal to that absorbed by the airscrew. The B.H.P. of the engine is itself affected by atmospheric conditions; the law governing the variation of the power is incapable of exact definition, but seems to depend upon pressure, density, and at times temperature.

The Power Factor

In standard atmosphere, in which the characteristics vary only with height, it is reasonable to assume that the power factor for altitude, ρ_e, is constant at each individual altitude. In a non-standard atmosphere, however, this is no longer the case, and it will be necessary to derive a set of values of ρ_e for the particular atmosphere under consideration. In the absence of more accurate information the only course appears to be that of using the same combinations of relative pressure (p), relative density (σ), and relative absolute temperature (T) as those which give close approximations to the power factors for altitude in general use for estimates of performance in standard atmosphere. These are as follows :—

Normally aspirated engines	$\rho_e = \dfrac{p^{1.1}}{T^{\frac{1}{2}}}$
Supercharged engines	$\rho_e = p^{\frac{1}{2}}\sigma^{\frac{1}{2}}$

In using these factors it should be remembered that the corrections must be applied to the B.H.P. at full throttle at zero altitude in standard atmosphere, and not to the ground level conditions in the new non-standard atmosphere under consideration, and, in the same way, the values of p, σ, and T are the ratios of the pressure, density, and absolute temperature at any given height in any atmosphere to the corresponding values at zero height in standard atmosphere.

Before making any attempt to estimate the performance of a machine in a non-standard atmosphere it is first necessary to determine the conditions prevailing at a series of tape-line heights in that atmosphere. The method of doing so is shown in the following example.

Suppose that the worst atmospheric conditions likely to be encountered by an air line operating in the tropics occur when the barometric pressure at mean sea level is 730 mm., and the corresponding temperature is 45° C., the only further information being that the temperature gradient may be taken as being the same as that in standard atmosphere. It is stated also that the engines used are normally aspirated.

We will proceed to find the values at tape-line heights of 0, 5,000, 10,000, and 15,000 feet in the new atmosphere of p, σ, and T relative to the corresponding values at zero height in standard atmosphere.

(1) At 0 feet

Absolute temperature = 45 + 273° C.

$$\therefore T_o = \frac{45 + 273}{15 + 273} = 1.104$$

and

$$p_o = \frac{730}{760} = .961$$

whence

$$\sigma_o = \frac{0.961}{1.104} = 0.87$$

For normally aspirated engines

$$\rho_{e_o} = \frac{0.961^{1.1}}{1.104^{\frac{1}{2}}} = 0.9109$$

(2) At 5,000 feet.

The pressure per unit area at any height is equal to the pressure at H = 0 less the weight of the column of air, of unit cross sectional area, extending from H = 0 to the height in question.

If P is the absolute pressure and ρ the absolute density, the difference in pressure is given by

$$dP = -\rho g . dH$$

On the assumption that air is a perfect gas, we have

$$\rho g = \frac{P}{R\theta}$$

where θ is the absolute temperature, and R is the gas constant for air. Combining the two equations we get

$$\frac{dP}{P} = -\frac{1}{R\theta} dH$$

whence, by integration between the appropriate limits

$$\log_e P_H - \log_e P_o = -\frac{1}{R\theta}(H_H - H_o)$$

or $\log_e \frac{1}{p} = \frac{H}{R\theta}$, where H is the height interval.

If H is in feet and θ in degrees centigrade, the value of the gas constant, R, is 96.04, and the equation becomes

$$\log_{10} \frac{1}{p} = \frac{H}{221.14\theta}$$

For rigid accuracy, particularly when the height interval is considerable, the value of θ used in this equation should be a harmonic mean between the values of θ at the upper and lower limits of the height interval under consideration, its value being given by

$$\theta \text{ mean} = \frac{0.00198\ H}{\log_e \frac{\theta_o}{\theta_H}}$$

where the suffixes o and H denote the lower and upper limits respectively. For our purposes it will be sufficiently accurate to take the arithmetic mean, which gives a value of 313.05° C. instead of 313.7° C., the harmonic mean as given by the above equation.

Relative Pressure

The value of p, the relative pressure, obtained by the use of the above equations is the ratio of the pressures at the upper and lower limits of the height interval in the atmosphere under consideration, and does not of necessity indicate the pressure relative to that at zero height in standard atmosphere. Denoting the relative pressure for the height interval by p′ and employing the appropriate values of H and θ we get

$$\log \frac{1}{p'} = \frac{5{,}000}{221.14 \times 313.05}$$

and

$$p' = 0.8468.$$

We have found already that the value of p at mean sea level is 0.961, so at 5,000 feet

$$p = 0.8468 \times 0.961 = 0.8138$$

The remaining constants are found as before :

Absolute temperature = 318 − 0.00198 × 5,000 = 308.1° C.

whence

$$T = 1.0698$$

$$\sigma = \frac{0.8138}{1.0698}$$

$$= 0.7588$$

and $\rho_e = 0.7707$

(3) At 10,000 feet.

The altitude constants at this height may be found either from those last calculated, using a height interval of 5,000 feet, or from the known values at mean sea level, using a height interval of 10,000 feet. If the mean temperature over the interval is to be taken as the arithmetic mean between the upper and lower limits it is advisable to use the smaller interval, and to convert p' to p as before. Proceeding in this manner the following values are obtained:

$$p = 0.6854$$
$$T = 1.0354$$
$$\sigma = 0.6619$$
$$\rho_e = 0.6474$$

(3) At 15,000 feet.

From the height interval between 10,000 feet and 15,000 feet, and using the arithmetic mean temperature as before, the following figures are obtained

$$p = 0.5756$$
$$T = 1.0010$$
$$\sigma = 0.5750$$
$$\rho_e = 0.5444$$

At this stage it is as well to recalculate the value of p at 15,000 feet, using the whole height interval from mean sea level, as a check on the accuracy of the work done up to date. In this case, since the height interval is considerable, the value of the mean temperature used will be the harmonic mean between the upper and lower limits.

$$\theta \text{ mean} = \frac{15{,}000 \times 0.00198}{\log_e \frac{318}{288.3}}$$

$$= 302.91^\circ \text{ C.}$$

$$\log \frac{1}{p'} = \frac{15{,}000}{221.14 \times 302.91}$$

whence $p = 0.5738$

From this it will be seen that the error introduced by the use of the arithmetic mean temperature is rather less than one-third per cent.

Having determined the atmospheric conditions in the new atmosphere it will be instructive to derive from them, for purposes of comparison, the corresponding pressure and density heights in standard atmosphere, remembering that the pressure height will be the height shown by a standard Aneroid. These are obtained from the following equations:

$$\text{Pressure height} = \frac{(1 - p^{\cdot 19}) \times 10^6}{6.8785}$$

$$\text{Density height} = \frac{(1 - \sigma^{\cdot 235}) \times 10^6}{6.8785}$$

Substituting in these equations the values calculated for the series of heights the following comparisons are obtained:

NEW ATMOSPHERE	STANDARD ATMOSPHERE.	
Tape-line Height.	Pressure Height.	Density Height.
0 ft.	1,100 ft.	4,670 ft.
5,000 ft.	5,580 ft.	9,150 ft.
10,000 ft.	10,080 ft.	13,430 ft.
15,000 ft.	14,460 ft.	17,730 ft.

It will be noticed that the height intervals as measured by the standard Aneroid differ considerably from the actual tape-line heights. Variations of the same order would occur if an isothermal altimeter were used; actually such an instrument, set to read zero at sea level, would at tape-line heights of 5,000, 10,000, and 15,000 feet read 4,250, 9,200, and 13,950 feet respectively.

When the altitude constants have been determined in the manner described the performance estimate is made in the usual way. When this is done it must be remembered that the heights to which the estimated figures are referred are the tape-line heights in the new atmosphere, and that the figures cannot be taken to apply any other atmosphere. Consideration of the table of comparative heights will make it obvious that the performance in the new atmosphere cannot be derived from that in standard atmosphere, on account of the wide divergence of conditions of temperature, pressure, and density which prevails at every height.

THE STRESSING of MULTI-SPAR WINGS

By HAROLD N. HORNE

An Extension of the Method Explained in a Previous Article by the same Author

IN a previous article (1) a method of finding the loads in the spars and also in the covering, for a wing with 2 spars and stiff covering, was given. It was shown how this method could be applied when the spars were parallel, or non-parallel, and when the values of I of the spars did not vary similarly with each other along the span. This method has since been extended to enable the loads in the spars and the skin to be found when the wing has more than two spars and the covering is such that it adds to the torsional stiffness of the wing.

The approximations used in (1) have been retained, as it was found that they considerably simplify the work and enable results to be obtained quickly, without introducing any appreciable errors in calculations on an actual wing. The general method is the same as in (1) but, owing to the difficulty of finding the correct distribution of the load between *several* spars, when the magnitude and position of the load, relative to the spars, is known, the problem has been approached in the reverse direction. Instead of finding the flexural line, and then finding the loads on the spars, the loads on the spars *to give equal deflections*, are first found and then the flexural line obtained from these loads.

The general method is as follows—

(*a*) The load system along the wing is divided into two systems.

(1) A system which gives pure flexure.

(2) A torque system.

These two are the same as were required for a two-spar wing and the same methods are employed modified to suit multi-spars. Having obtained the torque on the wing, this torque is shared between the skin in shear and the spars in differential bending. If T is the torque at any section and t the amount of torque taken by the skin, the remaining torque $(T - t)$ is applied to the spars. The final loads on the spars are those due to the flexural system with the addition of the loads due to the remaining torque $(T - t)$.

The Loads on the Spars for Equal Flexure

The loading on a spar for pure flexure is given in R. & M. 1617 (2) and is as follows:

Equation (1) $wr = Rw + 2\frac{dR}{dx}\int_0^x wdx + \frac{d^2R}{dx^2}\int_0^x\int_0^x w\,(dx)^2$

using the notation given in the previous article or in R. & M. 1617 (2).

In the previous article it was shown that the flexural line (r) could be drawn direct when the " R " line was straight for the two cases of (1) uniform loading along the span. (2) a loading of o at the tip and varying uniformly to the root. Interpolation between these two for the loading under consideration gives the flexural line.

The same principle is now applied to obtain the *load* curves on the spars, to give pure flexure.

When the " R " line is approximated by straight lines

$$\frac{dR}{dx} = \text{constant and } \frac{d^2R}{dx^2} = 0$$

Equation (1) then becomes—

$$wr = Rw + 2\frac{dR}{dx}\int_0^x wdx \quad \text{(Equation 1}a\text{)}$$

(r) is the ratio of the load on a spar to the total load on the wing at any section.

It is seen, therefore, that this *ratio* is a variable according to the variation of w, with respect to x.

For $w = 1.0$ (Uniform Load along the span).

Equation (2) $r = R + 2x\frac{dR}{dx}$ is derived from Equation (1a)

and the curve for this ratio can be drawn direct. For w as a variable with x (A loading commencing with o at the tip and varying linearly to 1.0 at the root).

Equation (3)

$$r = R + x\frac{dR}{dx} \text{ is derived from Equation (1)}$$

This also can be drawn direct.

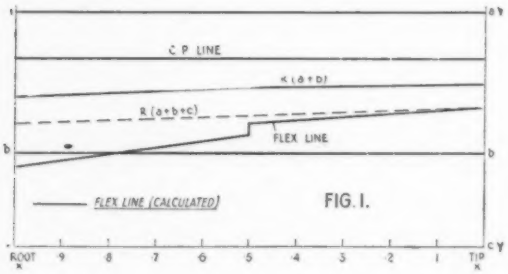


FIG. 1.

For any loading along the span between the above two limits, the values of (r) can be obtained by interpolation between the above, for the loading under consideration.

The actual load along the spar is then the value of (r) found, for the type of load distribution along the wing, multiplied by the ordinates of the load curve, for the wing.

Example

Reference Fig. 1.

This shows a wing with 3 spars (a) (b) (c).

For simplicity, the spars are shown parallel and the loading will be taken as uniform along the span, but for non-parallel spars the following method is modified as was done for a two-spar wing. The values of I of the spars taken in the example are such as to give a discontinuity in the flexural line so that the correction for this can be shown and applied, as was done for a two spar wing.

Calculate the values—

$$\frac{Ia}{Ia + Ib + Ic} \quad \frac{Ib}{Ia + Ib + Ic} \text{ and } \frac{Ic}{Ia + Ib + Ic};$$

these are given in Table 1.

These values are plotted in Fig. 2 and shown as Ra, Rb, and Rc. Values of loads, w_a, w_b, and w_c are obtained as follows—

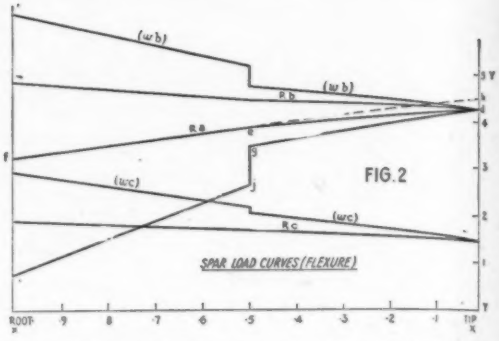


FIG. 2.

(w_a) For uniform load along the wing.

Draw from d, a line dg, of 3 times the slope of de. Produce fe to meet the yy axis.

Draw a line j, k, which is 3 times the slope of hf, commencing at h, and drawn over the portion of the spar (ef).

Join g to j, by a line, parallel to axis yy.

This gives the (r) curve for spar (a) (See Equation 2). Similar constructions give the (r) curves for spars (b) and (c).

In this example, the loading along the span being uniform ($w = 1.0$), the (r) curves and the load curves are the same, and need not, therefore, be re-drawn.

If the load along the span had been tapered (Equation 3) the same procedure would be followed, but the slopes would be at twice the slope of the " R " line (see Equation 3).

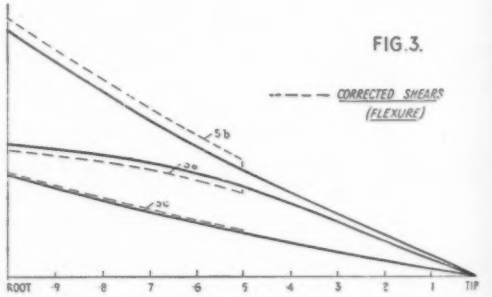


FIG. 3.

For a variable wing loading interpolation between the two, would give the requisite values for (r).

It must be noted that for any loading except uniform, the (r) curves as found are to be multiplied at any point by the value of the wing load curve at that point, to obtain the spar load curves. It will be seen, therefore, that this method enables the spar loadings for pure flexure to be obtained quickly and easily for any type of wing loading. Integration of the load curves so obtained gives the shear for each spar.

Owing to the discontinuity in the load curves due to the abrupt change in the values of R at .5 of the span, a correction to the shear has to be applied. This correction is the same as for a two-spar wing and is as follows—

The shear inboard of the point of discontinuity is to be increased or decreased by the following—

$$= 1/2\ w\ x^2\left(\frac{dR}{dx}\text{ inboard} - \frac{dR}{dx}\text{ outboard}\right)$$

x is the distance from the tip to the point of discontinuity.

w is the spar loading at x.

$\frac{dR}{dx}$ is the slope of the R line and is positive when R

increases when moving along the $x\,x$ axis from the tip. The shear curves with corrections are shown in Fig. 3. Integration of these curves gives the curves of B.M. for pure flexure of the spars. These are shown in Fig. 4.

An interesting means of checking the B.M.s curves so obtained, and so checking the load curves for the spars, is now possible.

Reference R. & M. 1617 (1) *Page* 4. *Equation* 7.

$$\int_0^x \int_0^x wr\,(dx)^2 = R \int_0^x \int_0^x w\,(dx)^2 \text{ (Equation 4).}$$

or M (spar) = R (spar) × M where M is the total wing moment.

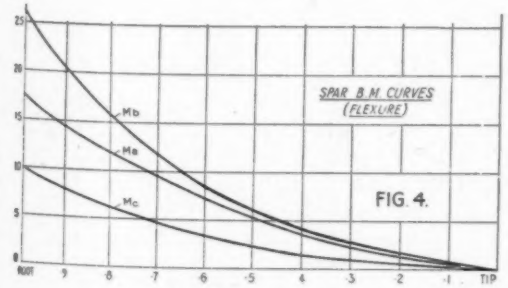
i.e., The moment on a spar at any point is equal to the Total *Wing* Moment at the point multiplied by the value of " R " for the *spar* at that point.

TABLE 1.

Point on Spar.	Ia	Ib	Ic	S= Ia+Ib+Ic	Ia/S	Ib/S	Ic/S
Tip	1.5	1.5	.5	3.5	.429	.429	.143
.1	1.48	1.52	.52	3.52	.421	.432	.148
.2	1.46	1.54	.54	3.54	.413	.435	.153
.3	1.44	1.56	.56	3.56	.405	.439	.157
.4	1.42	1.58	.58	3.58	.397	.442	.162
.5	1.4	1.6	.6	3.6	.389	.445	.167
.6	1.36	1.64	.62	3.62	.376	.454	.17
.7	1.32	1.68	.64	3.64	.363	.462	.175
.8	1.28	1.72	.66	3.66	.35	.471	.179
.9	1.24	1.76	.68	3.68	.337	.478	.185
Root	1.2	1.8	.70	3.7	.323	.486	.191

TABLE 2.

Point on Spar.	Spar B.M.s. a	b	c	Check on B.M.s (by Equation 4). a	b	c
Tip	0	0	0			
.1	—	—	—	—	—	—
.2	1.2	1.7	.05	—	—	—
.3	2.2	2.6	.9	2.3	2.5	.89
.4	3.5	4.0	1.5	3.57	4.15	1.52
.5	5.0	5.6	2.15	4.95	5.67	2.13
.6	7.1	8.5	3.3	7.1	8.6	3.22
.7	9.3	11.7	4.5	9.25	11.8	4.46
.8	11.8	15.7	6.0	11.7	15.7	5.96
.9	14.3	20.2	7.7	14.2	20.2	7.7
Root	17.1	25.9	10	17.1	25.7	10.1



This method is perhaps the quickest way of finding the moments on the spars, but it is necessary to know the loadings on the spars to obtain the flexural line, and so obtain the torque system on the wing. As it is difficult to obtain load curves with any accuracy by double differentiation of the B.M curves, Equation 4 is only used to check the results obtained. Table 2 gives the values of B.M. for the spars (*a*) (*b*) and (*c*) at various points along the span, and a check on the results, obtained by Equation 4, is also given.

It is now possible to obtain the flexural line for the wing. This is the line of the centre of gravity of the spar loadings, and is obtained by taking moments about any datum parallel to the X X axis. The values are derived in Table 3 by taking moments about spar (*c*).

TABLE 3.

POSITION OF FLEXURAL LINE. (MOMENTS OF SPAR LOADS ABOUT SPAR (C)).

Point on Spar.	w_a	w_b	d_a	d_b	$w_a d_a$	$w_b d_b$	D
Tip	.429	.429	5	2	2.15	.86	3.0
.2	.391	.45	5	2	1.96	.90	2.86
.4	.355	.465	5	2	1.78	.93	2.71
.5	.34	.475	5	2	1.7	.95	2.65
.7	.192	.573	5	2	.96	1.15	2.11
.9	.12	.62	5	2	.6	1.24	1.84
Root	.085	.645	5	2	.43	1.29	1.72

The flexural line is plotted on Fig. 1. It could have been drawn by the method used in the article on a two-spar wing (1) as follows—

(1) Obtain values of R for spars (*a* and *b*).

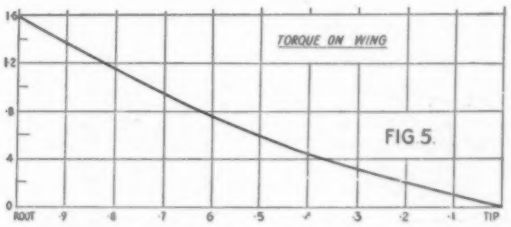
(2) Plot these values R $(a + b)$.

(3) Use this line as an equivalent spar Ic = Ia + Ib and combining with spar (*c*) obtain *Final* " R " line R $(a + b + c)$.

(4) Treating the equivalent spar and spar (*c*) as a two-spar wing, draw the flexural line as described in the previous article.

(5) The flexural line by this method checks with the calculated flexural line.

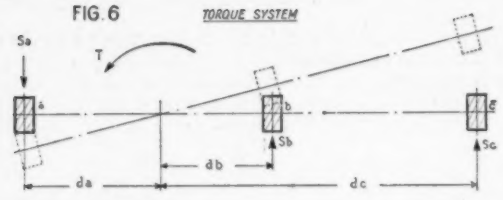
This completes the Flexural system and it is now possible to deal with the torque system.



The Torque System

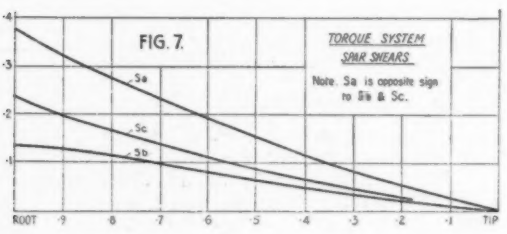
The increment of torque at any point is equal to the load at that point multiplied by the distance between the line of centre of pressure, and the flexural line. The integral of this, from the tip to any section, is the torque at that section. For the purpose of the example, a line of centre of pressure is drawn on Fig. 1 (C.P.). The curve of torque is given in Fig. 5. This torque is now shared between the skin in shear, and the spars in differential bending. The amount of torque taken by the skin can be found by the method of R. & M. 1617, or if the wing has some other form of torque bracing, an estimate of the torque taken by this will have to be made.

For the purpose of the example the torque left to be taken in the spars is as shown in Fig. 5. When a wing has two spars, torque is taken by the spars as a couple, the load on each spar at any point being $\frac{T}{d}$ where T is the torque at the section and *d* is the distance between the spar



centres. The method for a multi-spar wing will now be outlined.

Fig. 6 shows the spars at any section of the wing. The centre of rotation under a pure torque at any section of the wing is a point which is the centre of resistance of the spars. This is the point $R(a + b + c)$ shown on Fig. 1. and obtained when checking the flexural line. This will be proved later when it is shown that the loads obtained from this satisfy the following conditions :—



(1) $S_a + S_b + S_c = 0$ at any section.
(2) $S_a d_a + S_b d_b + S_c d_c =$ Torque at any section.
(3) The deflections of the spars are proportional to the distances from the centre of rotation.

The loads on the spars to satisfy these conditions are obtained as follows—

Take the values $\frac{I_a}{S}\ \frac{I_b}{S}\ \frac{I_c}{S}$ for the spars from Table 1.

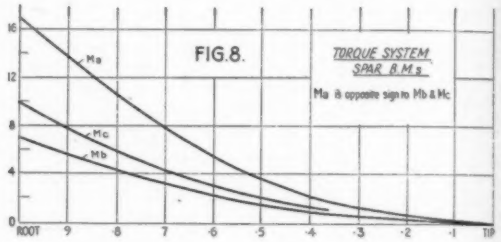
These are the ratio of the loads for equal deflections.

Derive the values $\frac{I_a d_a}{S}\ \frac{I_b d_b}{S}\ \frac{I_c d_c}{S}$

These allow for the difference in deflections required to satisfy (3) and are the final *ratios* of the spar loads.

The actual spar shears are obtained by multiplying these ratios by the value of the torque at each section under consideration and correcting for scale. As the torque at any section is the integral of the increments of torque from the tip, up to the section under consideration, the values so found are the *shears* on the spars. The spar B.Ms. are the integral of the shears so found. The values for the example will be obtained and checked to see that they satisfy the three conditions.

It will be found that the values of shear for the spars so obtained will satisfy the three conditions. To check condition (3) obtain values of $\frac{1}{d}\int_L^x \int_L^x \frac{M}{I}\,dx\,dx$ for each spar and these should be equal at any point along the wing. If the twist of the wing is required it can now easily be obtained by evaluating the spar deflections by the usual methods for beams, remembering that I is a variable. As



the deflections so found are those due to the part of the torque taken in the spars, and do not include flexure loads, from these deflections the true angle of twist of the wing at any point can be obtained.

The methods outlined in this article have been checked by using values for an actual wing, and gave very close results to those obtained by more elaborate calculations.

LIST OF REFERENCES.

(1) The Design of Monoplane Wings, by H. N. Horne, "The Aircraft Engineer," March 26 and April 30, 1936.

(2) Report and Memoranda 1617. May 1934. Aeronautical Research Committee.

TABLE 4.

Point on Spar.	$\frac{Ia}{S}$	$\frac{Ib}{S}$	$\frac{Ic}{S}$	da	db	dc	$\left(\frac{Ia}{S}\right)d_a$	$\left(\frac{Ib}{S}\right)d_b$	$\left(\frac{Ic}{S}\right)d_c$	T	True values of Sa	Sb	Sc
Tip	.429	.429	.143	2.0	1.0	3.0	.858	.429	.429	0	0	0	0
.2	.413	.435	.153	2.07	.03	2.93	.856	.405	.447	.21	.053	.0255	.0281
.4	.397	.442	.162	2.14	.86	2.86	.85	.38	.463	.44	.112	.0502	.0611
.6	.376	.454	.17	2.2	.80	2.80	.826	.364	.476	.76	.188	.083	.108
.8	.35	.471	.179	2.3	.70	2.70	.805	.328	.482	1.16	.28	.114	.168
Root	.323	.486	.191	2.4	.6	2.60	.775	.292	.496	1.58	.37	.135	.235

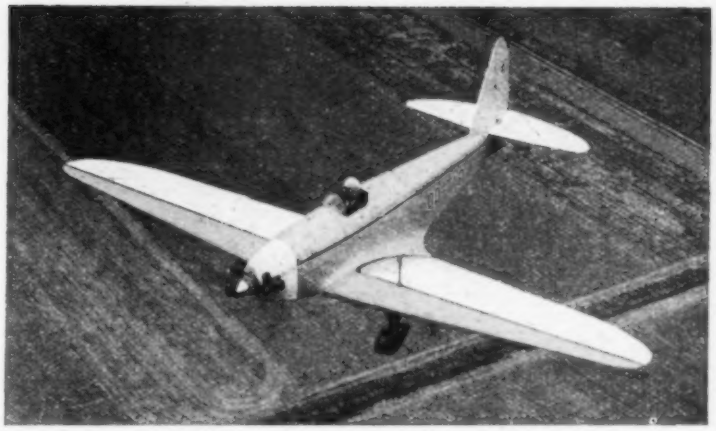
To obtain the scale correction find Sa, Sb and Sc at the root. Calculate $Sa\,d_a + Sb\,d_b + Sc\,d_c$ and equate to the torque at the root. This gives a correction factor to give the correct values for Sa, Sb and Sc.

$$x(1.23 \times 2.4 + .451 \times .6 + .785 \times 2.6) = 1.58$$
$$x(2.96 + .27 + 2.04) = 1.58$$
$$x = \frac{1.58}{5.27} = 0.3$$

The shear values for the spars are therefore $\left(\frac{Ia}{S}\,da\,T\right)$ 0.3, using the correct values for each spar. These are shown as Sa, Sb, Sc and are plotted in Fig. 6.

THE "TIPSY" in ENGLAND

A Single-seater with a Top Speed of 98 m.p.h. to be Sold for £265



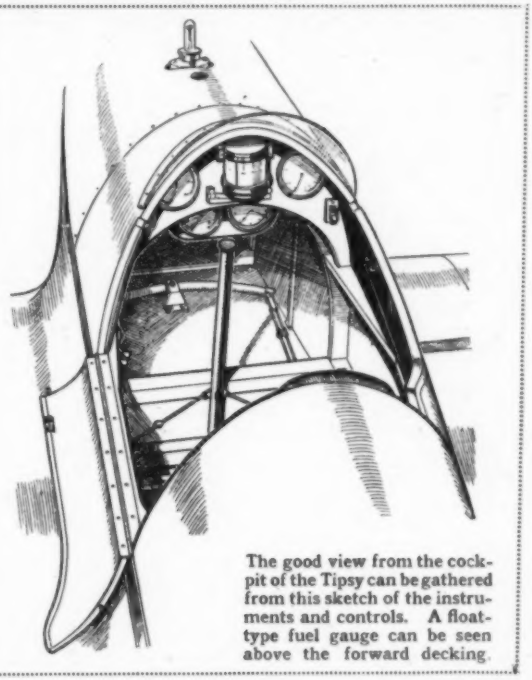
AS long ago as June 13, last year, the Tipsy S. low-wing monoplane was described in *Flight*, and at that time, before the ultra-light machine had made its complete re-appearance, the performance had seemed to be very remarkable in view of its extremely low power. In its latest form the Douglas engine is of 750 c.c., giving a consequently increased maximum speed. In the hands of Mr. Eyskens, the chief test pilot of Avions Fairey, the Tipsy, during its first demonstration in this country, showed that it did not suffer in comparison with the normal light aeroplane in the matter either of manœuvrability or of take-off run.

As might have been expected, the Tipsy S., which was designed by Mr. E. O. Tips of the Fairey Company, is now to be manufactured in this country—though, for the present, the maker's name cannot be divulged—and is to be sold for £265, so that it will, in fact, be the least expensive aeroplane at present on the British market. At its cruising speed of 70 m.p.h. the range is a matter of 400 miles (an endurance of 5.7 hours) and there is a locker with volume enough for a reasonable supply of necessary luggage, so that this new single-seater can be treated as a serious means of singleton transport.

Since the machine is an open single-seater it will probably appeal rather to the more sporting type of amateur, and for him the very effective controls will be a distinct joy. During the demonstration last Friday, the Tipsy was made to do all the more normal aerobatics and Mr. Eyskens did these at a low altitude with an ease and abandon which suggested that there was nothing tricky about its handling qualities. The view from the pilot's seat is remarkably good, and one can look almost vertically over the leading edge. Even in the tail-down position the view immediately ahead only is cut out. When in this attitude the pilot is, so to speak, almost sitting on the ground, so that the business of holding-off should present few difficulties.

In construction the Tipsy is mainly of wood, with ply-covered fuselage, tail plane, fin and leading edge. The cantilever wing has main and auxiliary spars with cross-members arranged in pyramid formation. Steel tubing is used for the engine mounting and for the bracing of the tail plane. The undercarriage, which consists of two separate and fully faired legs, is notably wide, the track being nearly 7 feet. In its present form the engine is started by very effective "string and pull" methods, but the production Sprite engine will, of course, have an impulse-starter magneto so that the engine can be started by swinging the airscrew in the ordinary way.

For the present, enquiries concerning the Tipsy S. should be made to Mr. M. C. Macpherson, Tipsy Aircraft, North Hyde Road, Hayes, Middlesex.



The good view from the cockpit of the Tipsy can be gathered from this sketch of the instruments and controls. A float-type fuel gauge can be seen above the forward decking.

TIPSY S. LOW-WING SINGLE-SEATER

Douglas Sprite Engine of 750 c.c.

Span	24 ft. 7in.
Length	18 ft. 8½in.
Height	4 ft. 9in.
All-up Weight	550 lb.
Maximum Speed	95–100 m.p.h.
Landing Speed	37 m.p.h.
Climb to 1,200 ft.	2 min. 25 sec.
Ceiling	14,000 ft.
Take-off Run	65 yards.
Landing Run	30 yards.
Range	400 miles.
Price	£265.

The diminutive dimensions of the Tipsy S. are apparent when the machine is seen parked beside the Fairey Swordfish. Mr. Eyskens is in the cockpit. (*Flight* photograph.)

LATEST TO THE CAPE

The Hillson Praga Shows Its Mettle

MR. H. L. BROOK, flying a Hillson Praga monoplane with a Praga "B" air-cooled flat twin engine of 40 h.p., has reached the Cape from Lympne in 16 days, 4½ hours. He left on May 6. It was his intention to do the trip in ten days, but detention in Sicily and Tripoli by the Italians, and headwinds on the later stages of the journey accounted for the increased time.

The machine used by Mr. Brook was actually a Czechoslovak-built model, but those being constructed in this country by F. Hills and Sons, of Manchester, are similar. The engines will be built under licence by Jowett Cars Ltd.

Essentially a side-by-side two-seater high-wing cantilever monoplane, the Hillson Praga is of wooden construction. The abridged specification is: Span, 36 ft.; length, 21 ft. 7 in.; wing area, 164 sq. ft.; weight empty, 584 lb.; weight loaded, 1,029 lb.; maximum speed, 93.3 m.p.h.; cruising speed, 79.6 m.p.h.; service ceiling, 10,800 ft.

A congratulatory cable, received by the Wakefield Company from Mr. Brook at Capetown, gives an idea of the conditions which he encountered, which included high temperatures in which the machine was flown for long periods at full throttle.

The fuel used was Shell.

Mr. Brook and the Hillson Praga.

THE ISLE of MAN AIR RACES

A FINE entry of twenty-five machines has been received for the Isle of Man Air Races this week-end. On Saturday, May 30, the London-I.O.M. Handicap Race takes place, starting from Hanworth and finishing over a line across Douglas Bay, the subsequent landing being made at Ronaldsway. The exact time of starting is not yet fixed, but in the event of a head wind will be fairly early—probably at about 9 a.m. A control, at which all competitors must land, will be established at Speke Aerodrome, Liverpool. Machines must also pass, at 200-400 feet, checking-points at Blackpool (Squire's Gate), St. Bee's Head Lighthouse, and Maughold Head Lighthouse.

All but two of the total entry are taking part in this event.

On the morning of Whit-Monday, June 1, the Manx Air Derby—again a handicap—takes place over three left-hand circuits of the Island, starting and finishing at Ronaldsway. All but seven of the total entry appear in the list for this event.

There are a number of cash prizes. First, second and third in Saturday's race will receive £100, £70, and £30 respectively, while there will be a £10 prize for fastest time, and the Duckham Trophy (value 25 gns.), for the first "B" licence pilot to finish. In the Manx Derby there are win and place prizes of £50, £30, £25 and £10.

Capt. Rex Stocken, 18/20, Lower Regent Street, London, S.W.1, (Whitehall 8863) is the organiser.

THE ENTRIES.

No.	Entrant.	Pilot.	Registration.	Machine.
1	W. Humble	Entrant	G-ACTE	Hawk
2	Blackpool and West Coast Air Services	John C. Higgins	G-ADVJ	D.H.86a
3	S. Gleave	—	G-AAYU	Avian
4	W. R. Porter	S. W. Sparkes	G-ADMI	Gull
5	A. Henshaw	Entrant	G-ACLO	Leopard
6	S. T. Lowe	Entrant	G-ABWE	Comper Swift
7	P. Randolph	Entrant	G-ACUL	Gull
8	Mrs. Elsie Battye	Entrant	G-ADLA	Hawk Major M.2H
9	Flt. Lt. W. D. Guyler and F/O. A. E. Clouster	F/O. A. E. Clouster	G-ADY	Aeronca
10	J. G. Hopcraft	Wing Cdr. J. W. Woodhouse	G-AASI	Tomtit
11	R. F. T. Giddings and J. Turner	R. F. T. Giddings	G-AAUG	Bluebird
12	L. Lipton	Entrant	G-ABUW	Moth
13	S. L. Turner	Entrant	G-AFAI	Cessna C.34
14	Flt. Lt. T. Rose	Entrant	G-ADLC	Falcon J.1
15	E. F. Walter	Entrant	G-ADGE	Hawk
16	Redhill Flying Club	R. F. Bolstrode	G-ACWZ	Autogiro
17	B. Gray	R. F. Hall	G-AEEU	Hillson Praga
18	C. Ogle	Entrant	G-ADMJ	Hornet Moth
19	I. P. Tidman and S. B. Yardley	I. P. Tidman	G-EBRO	Widgeon
20	British Aircraft Manufacturing Co.	—	—	Swallow
21	C. H. Tutt	Entrant	G-ABPK	Moth
22	H. R. A. Edwards	Entrant	G-ABEE	Avian
23	Mrs. M. Glass	Miss M. Glass	G-ABOE	Moth
24	G. Cohen	G. Cohen and B. Wilson	G-AAXT	Puss Moth
25	A. J. Walter	J. Beard	G-AEIK	Taylor Cub

Note.—Nos. 6 and 11 are not taking part in the London–I.O.M. Race, and Nos. 8, 14, 15, 16, 18, 19 and 23 are not entered for the Manx Air Derby.

Pou-du-Ciel Accidents

THE following letter, on a topical subject, has been received from Capt. A. G. Lamplugh, of the British Aviation Insurance Company, Ltd.:—

"The recent accident to Sqn. Ldr. Davidson, the Chief Flying Instructor of No. 2 Flying Training School at Digby, whilst flying a *Pou-du-Ciel*, cannot but be a further and serious reminder of the present unsatisfactory position.

"We have now had three fatal accidents in this country on Flying Fleas. All three have involved experienced aeroplane pilots, and the last two have occurred, respectively, to the official test pilot of the Empire Air League and to an exceptionally experienced flying instructor.

"If the total number of fatal accidents is considered in proportion to the total number of machines of this type which have done any appreciable flying, the percentage ratio must necessarily be a matter of serious concern.

"Without wishing to enter into any technical discussion as to the merits, or demerits, of the type, the evidence justifies one in asserting that the flying of this type calls for (at the very least) a special technique as distinct from that of flying on more conventional types.

"It seems possible that this point has not received from the supporters of the movement the consideration which it manifestly deserves, and some effort should be made to point out to enthusiastic but non-technical adventurers that inherent handling difficulties are involved which should at least be satisfactorily cleared up from the technical point of view before further flying is carried out. Bearing in mind the fact that this type does not at the moment require a certificate of airworthiness I venture to suggest that serious consideration should be given to this point by those responsible and those who are supporting the movement. Unless this point is clearly recognised, I cannot help feeling that we are running a serious risk of further damage, both corporal and material."

THE WILBUR WRIGHT LECTURE

Seventieth Anniversary of the R.Ae.S. Lends Interest to an Important Annual Event

STUDYING THE EXHIBITS: (Left to right) Mr. R. Fairey, Mrs. Fairey and Mr. C. R. Fairey; Mr. J. E. Hodgson (the expert on early aeronautical history), Lord Sempill, Mrs. E. C. Gordon-England, Miss Daphne Gordon-England, and Mr. Gordon-England; Lt. Col. Sir Francis Shelmerdine (Director General of Civil Aviation) and Lt. Col. J. T. C. Moore-Brabazon (President of the R.Ae.S.).

HELD last Thursday, the Royal Aeronautical Society's annual reception at the Science Museum, South Kensington, gained added interest and importance by reason of the fact that this year sees the 70th anniversary of the founding of the Society. A special exhibition of historical relics was shown in commemoration.

As usual the proceedings began with the presentation of the awards, and a list of the recipients appears at the end of these notes. This ceremony was followed by the reading of the Wilbur Wright lecture, the lecturer this year being Mr. D. R. Pye, M.A., F.R.Ae.S., M.I.Mech.E., and the title of his lecture being "Slippery Surfaces." This, it turned out, dealt with lubrication, and the lecturer delivered a most interesting paper on this very obtuse subject, succeeding, most ingeniously, in making it intelligible to an audience composed largely of members' wives and lady friends.

Mr. Pye began by giving a description of the condition of matters in a lubricated journal bearing, and pointed out that careful experiments have shown that in this case there are usually some thousands of oil molecules between the shaft and the bearing. He went on to discuss boundary lubrication, in which it could be shown that there was only a single layer of molecules between the surfaces. Such a condition of things in a normal bearing would lead to an imminent risk of breakdown if it occurred for an appreciable length of time.

From this he went on to discuss lubricating oils generally, and pointed out that these fell into two groups, in both of which the molecules have the shape of a chain. In one group, the mineral oils, each end of the chain is alike, and in the other, the vegetable and animal oils, one end of the chain possesses unsatisfied oxygen molecules which are anxious to adhere to any metal surface presented to them, so that a layer of molecules of this type on such a surface may be compared with a field of growing corn. On the other hand, the mineral oil molecules arrange themselves at random.

Mr. Pye then proceeded to describe some recent experiments to discover the actual temperature conditions in a bearing. There is a well-known property of metals, exemplified by the thermopile, that if two different metals are connected together and the junction is heated a voltage will be generated which is proportional to the temperature. In order to make use of this phenomena for the purpose desired, a metal disc, capable of rotation, was used, and at some distance from the centre a pencil of another metal was pressed on it with the aid of a spring. The disc was covered with oil and rotated. The voltage produced over the junction between the pencil and the disc could be easily ascertained by normal electrical methods, and the result showed that the actual temperatures were surprisingly high. Mr. Pye pointed out that the temperature of the disc and the pencil did not rise appreciably, and that the high temperature was confined to the molecules of the metals which were actually at, or very close to, the points of contact. He emphasised the importance of this result, pointing out that the temperature of the lubricant between the disc and the pencil must be equally high, and that this may result in the complete revision of our ideas of the nature of the best lubrication oil for severe conditions. One direction in which revision was likely was that it might be necessary to increase considerably the temperature at which lubricating oils are required to remain stable.

After the lecture members and their friends adjourned to the buffet or to the special exhibition which the Society had arranged. This contained a number of exhibits to illustrate the early history of the balloon, the aeroplane, and the Society, most of which were shown for the first time. Among them were relics of the property of Sadler, the first British aeronaut, including his silver compass. Original drawings of the Henson and Stringfellow machine were shown, and there was also an original drawing of one of Pilcher's gliders. The Society exhibited the first volume of its first minute book (opened at the page showing the first meeting), and a number of books and relics from its collection, including the first passport issued to a pilot of aircraft. This was dated 1836, and belonged to "Charles Green, aeronaut."

Those who had not the opportunity of being present at the reception can see the collection at the Science Museum, where it will be on view for one month.

At the Council Dinner

The reception was preceded by the annual Council dinner, and the following were present as guests of the Council:—

The American Ambassador, Viscount Swinton, Major Baden-Powell, the Belgian Ambassador, Prince Von Bismarck, Sir William Bragg, Capt. Davey, Mr. Griffith Brewer, Mr. C. R. Fairey, A.V.-M. Freeman, Mr. J. M. Kennedy, Dr. F. W. Lanchester, Lt. Col. Scanlon, Sir Francis Shelmerdine, Lt. Comdr. Stevens, Mr. H. T. Tizard, and Mr. J. D. Watson.

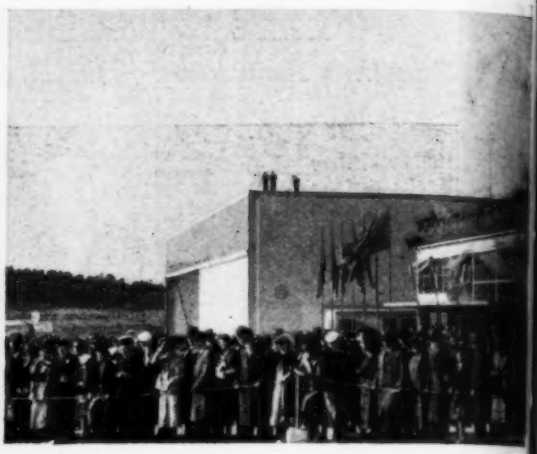
Among those present at the reception were:—

Capitaine de Corvette Albertas, Capt. Natal Armand, the Duchess of Bedford, Group Capt. Briggs, Col. Calderara, Air Comdre. Chamier, Engineer G. Gervassy, Mr. H. R. Gillman, Maj. Halford, Air Comdre. Hearson, Group Capt. Hynes, Mr. W. Lappin, Mr. C. F. G. McCann and Mrs. McCann, Sir Francis McClean and Lady McClean, Lt. Col. Lockwood Marsh and Mrs. Lockwood Marsh, Mr. and Mrs. J. T. Naylor, Mr. P. P. Nazir, Mr. and Mrs. E. Ower, Cdr. H. E. Perrin, Capt. H. Petre, Sqn. Ldr. Potts and Mrs. Potts, Mrs. Pye, Mr. and Mrs. E. F. Relf, Maj. J. C. Savage and Mrs. Savage, Lady Shelmerdine, Mr. and Mrs. H. O. Short, Mr. F. R. Simms and Mrs. Simms, Prof. R. V. Southwell, Mr. and Mrs. H. J. Stieger, Sir Alliott Verdon-Roe, Air Comdre. Verney, Col. R. Wenninger, Mrs. Wimperis, Mrs. Wingfield.

Awards of medals was made by the President, Col. J. T. C. Moore-Brabazon, as follows:—

British Gold Medal for Aeronautics, Dr. H. Eckener; British Silver Medal for Aeronautics, Mr. A. J. Rowledge (these gentlemen were unable to be present, so the awards were formally announced); Silver Medal of the Royal Aeronautical Society, Mr. B. N. Wallis; Simms Gold Medal, Mr. W. S. Farren; Taylor Gold Medal, Mr. E. F. Relf; Sir Charles Wakefield Gold Medal, Mr. C. R. Fairey; Busk Memorial Prize, Mr. R. P. Alston.

King Gustav V of Sweden opens the new Stockholm airport at Bromma. On his right is the Crown Princess and Princess Sibylla is on his left.



NORTHERN

Official Opening of Stockholm's New ... standing Event in the Stock...

(Illustrated ...

AFTER many days of beautiful weather the Swedish farmers' prayers for rain were answered last Saturday, the day appointed for the official opening of Bromma, Stockholm's new airport. The function gained added importance by reason of the fact that the opening formed part of the Stockholm Aero Show festivities.

At 3 p.m. the King, looking very well despite his advanced age, performed the opening ceremony, accompanied by the Princess Royal, Princess Sibylla and officials. With teeming rain and a cold wind, the clouds were down to less than 400 feet; these conditions prevented the arrival of the A.B. Aerotransport machines which were due to fly from Malmö, and they did not turn up until late in the evening. However, the crowd was treated to a very fine show of stunt flying by Lt. Höök Nilsson on the single-seat Sparmann. His slow rolls and crazy flying were particularly good.

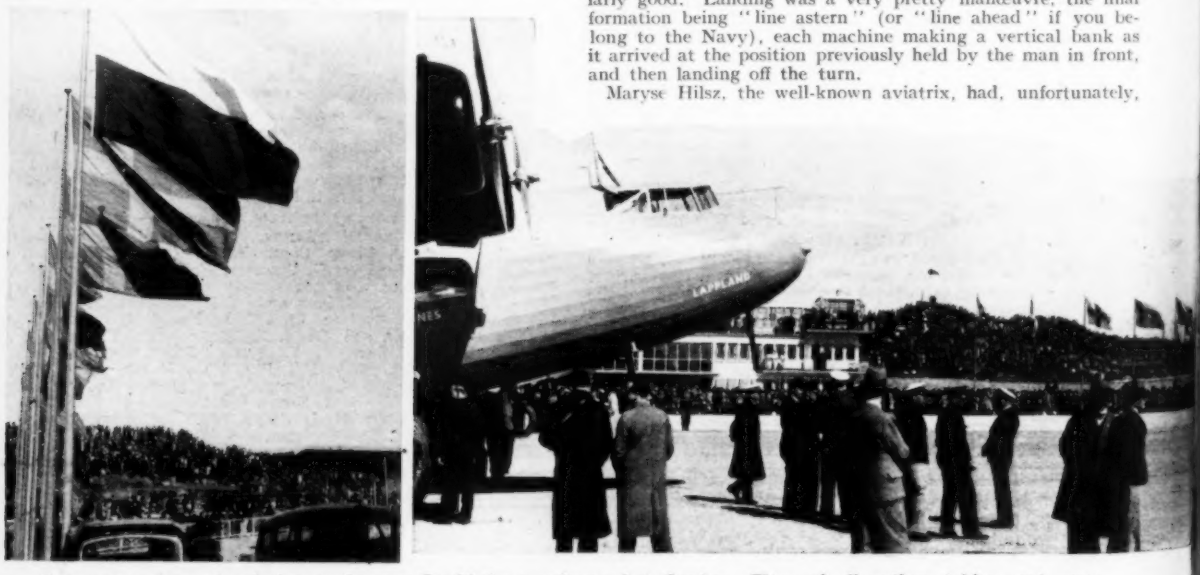
Having regard to the weather conditions the formation flying by nine Sk.10 machines—of German Raabe Katzenstein design, built under licence in Sweden—which completed the programme, was excellent. These machines were from the Swedish Air Force school at Ljungbyhed.

For the flying programme last Sunday the weather was just as perfect as that of the previous day had been wretched. All the transport machines were lined up in front of the big hangar, Swedish to the front. They made a very representative show, including, as they did, aircraft from England (British Airways and British Continental), Germany, France, Belgium, Holland, and even a Polish Air Lines Electra.

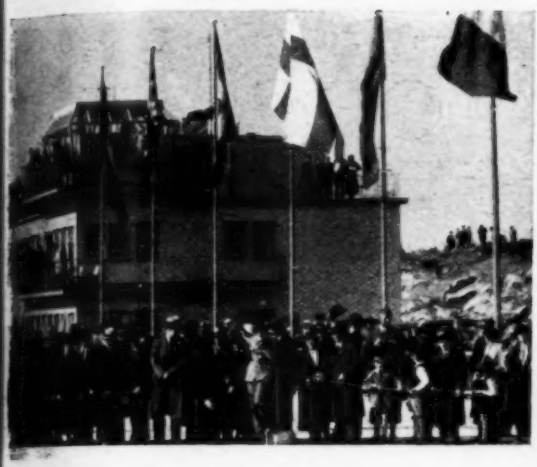
The programme opened with demonstrations by glider pilots on Rhonsperber sailplanes, Cierva Autogiros being used for towing them to the required height.

The Sk.10s, which had made such a gallant effort on the previous day, were able to go through the whole of their programme. It can be said that this squadron, and also a squadron from Västeras—composed of three Bristol Bulldogs and six Swedish Jaktfalk machines—which flew later in the afternoon, formated with a precision equal to anything to be seen in any country, the flying in echelon being particularly good. Landing was a very pretty manœuvre, the final formation being "line astern" (or "line ahead" if you belong to the Navy), each machine making a vertical bank as it arrived at the position previously held by the man in front, and then landing off the turn.

Maryse Hilsz, the well-known aviatrix, had, unfortunately,



Two scenes from the display at the new Stockholm aerodrome last Sunday. Flags of all nations taking part were generously displayed.



(Centre) The airport buildings and some of the 100,000 people who witnessed Sunday's display. (Above) Erie and Von Bahr demonstrate their Autogiros.

TERMINUS

Airport by the King of Sweden an Out-

holm Aero Show Fortnight

("Flight" Photographs)

sustained severe injuries in a crash the previous day and was, of course, unable to give her show, the space in the programme being filled by a demonstration flight of the Swedish Aerotransport liners *Lappland* (Fokker F.22), *Holland* (Northrop), *Varmland* and *Ostergotland* (Junkers).

Amid terrific enthusiasm, Lt. L. G. H. Thunberg, of the Swedish Royal Air Force, winner of the Nordic Cup, flew over from Barkaby aerodrome on the Bristol-engined Fokker S6A with which he had won the race.

The next item suggested that for one type of aircraft, at least, Bromma Aerodrome is far too large. Brie and Von Bahr demonstrated Autogiros by going through the whole of their repertoire very impressive and finished.

Germany was responsible for the remainder of the programme, with a flight by the huge Junkers G.38 and inverted flying by Emil Kropf on a Focke-Wulf Stieglitz. The latter was certainly a marvellous show if considered purely from a stunt-flying point of view, but very dangerous. Inverted loops were executed with the bottom of the loop little more than a hundred feet from the ground, and inverted dives and zooms at a much lower altitude.

In the hangar, ready for the morrow's demonstrations, were all the various types of machines which had flown over for this purpose. These included the D.H. Dragonfly, Airspeed Envoy, Percival Gull, Leopard Moth, B.A. Eagle and Swallow; Smith's "instrument laboratory" Dragon, Aeronca, Hawk Major, D.H. Hornet, Focke-Wulf 58, and Bücker Jungmeister.

The aerodrome itself is a very fine piece of work and has presented several problems not usually met with in aerodrome construction. For instance, several small hills of rock have had to be blasted away. There is still one which is being removed, and pilots landing must keep a weather-eye open, as they may arrive at the moment when several tons of rock are shot skywards. Concrete runways face almost every direction and the gaps between will eventually be grass. At the moment only those on the south-western side have been seeded. The longest run will be north-west—south-east, and it seems rather a pity that almost directly in line with this runway there are two very tall wireless masts outside the aerodrome.

Hangar space has been provided generously. Although the roof is uncurved there are no internal pillars, and even our biggest commercial machines should have plenty of elbow room. The great doors are in two sections only and are operated electrically, a gong ringing the whole time a door is moving.

The Nordic Cup Race: The Fokker S.6.A. (Bristol Pegasus) on which Lt. L. G. H. Thunberg, of the Swedish Royal Air Force, won the race, and (right) Lt. Thunberg with the trophy.

THE ROYAL AIR FORCE

SERVICE NOTES AND NEWS — AIR MINISTRY ANNOUNCEMENTS

VISCOUNT SWINTON

The Air Ministry announces:—

His Majesty the King has been pleased to approve the appointment of the Right Hon. Viscount Swinton, G.B.E., M.C., Secretary of State for Air, as Honorary Air Commodore of No. 608 (North Riding) (Bomber) Squadron, Auxiliary Air Force.

It is appropriate that the present Secretary of State should be appointed Hon. Air Commodore of this Squadron, in view of his connection with Yorkshire. Born in the county, Viscount Swinton has his home in and takes his title from the North Riding. No. 608 (North Riding) (Bomber) Squadron is stationed at Thornaby, near Middlesbrough.

It may be added that three former Secretaries of State have been appointed to similar rank in the Auxiliary Air Force; Capt. F. E. Guest, M.P., as Air Commodore of No. 600 (City of London) (Fighter) Squadron; Sir Samuel Hoare, M.P., as Air Commodore of No. 604 (County of Middlesex) (Fighter) Squadron, and the Marquess of Londonderry as Air Commodore of No. 607 (County of Durham) (Bomber) Squadron.

HONOURS AND AWARDS

The following rewards in recognition of gallant and distinguished service rendered in connection with the Mohmand operations on the North West Frontier, India, during the period August 15-16 and October 15-16, 1935, were published in the *London Gazette* of May 8, 1936:—

Distinguished Service Order

Sqn. Ldr. Kenneth Harries Riversdale-Elliot.

Distinguished Flying Cross

Sqn. Ldr. Henry Frederick Vulliamy Battle, Flt. Lts. North Carter, and Arthur Francis Hutton.

Distinguished Flying Medal

Sergt. (Pilot) Harold Constantine Smith, Cpl. Vincent Evan Morgan Watkins, L.A/C. (now Cpl.) Douglas Rupert Woolnough.

B.E.O. Medal (Mil.) for Meritorious Service

Flt. Sergt. Raymond Stewart Robertson.

Mentions

Wing Cdr. W. B. Farrington, D.S.O., Sqn. Ldrs. K. H. Riversdale-Elliot, J. MacG. Fairweather, D.F.C., H. P. Lloyd, M.C., D.F.C., R. T. B. Houghton, A.F.C., S. D. Culley, D.S.O., Sqn. Ldr. (now Wing Cdr.) P. F. Fullard, D.S.O., M.C., A.F.C., Flt. Lts. H. G. Brookman, (now Sqn. Ldr.) B. E. Embry, A.F.C., T. J. Arbuthnot, E. C. Hudleston, F. G. H. Ewens, F/O. R. S. Howe, Flt. Sergts. H. Wright, W. J. Ralphs, R. C. Drury, A. Fisher, Cpl. (now Acting Sergt. Paid) B. J. Brooks, L.A/Cs. E. W. Smith, (now Cpl.) J. H. Graham, J. A. Talkington.

CHANGES IN TITLE

The following changes in title have been made with effect from May 1, 1936:—

Late Title	*New Title*
No. 22 Group	No. 22 (Army Co-operation Group)
No. 23 Group	No. 23 (Training Group)

No. 5 FLYING TRAINING SCHOOL, SEALAND

The undermentioned officers and airman pilots have been awarded special assessments as shown hereunder on completion of a course of *ab initio* flying training at No. 5 Flying Training School:—

Special Distinction

A.P/O.s J. E. Cryer, J. B. Russell, A./Sergt. V. C. Otter.

Distinguished Pass

A.P/O.s G. A. Corder, A. D. C. Fair, A. J. Trumble, A. W. Fletcher, J. Vivian, A./Sergts. S. G. Taylor, L. C. Boore.

ELECTRICAL AND WIRELESS SCHOOL

The undermentioned officer is granted the symbol "S":—Flt. Lt. A. C. Watson.

THE BRISTOL BLENHEIM

It is likely that the production-type Bristol Blenheim medium bomber (type 142M) will be fitted with two Bristol Mercury engines of the latest pattern, giving a normal output of 720 h.p. at 12,500 ft. and a maximum of 840 h.p. at 14,000 ft.

R.A.F. DISPLAY STAFF

Air Vice-Marshal P. B. Joubert de la Ferté, C.M.G., D.S.O., commanding No. 11 (Fighter) Group, Uxbridge, will again act as A.O.C., Flying, at the R.A.F. Display on June 27, for the third year in succession.

Air Comdre. J. H. S. Tyssen, M.C., will be his chief staff officer, and Sqn. Ldr. G. Harcourt-Smith will serve as secretary to the A.O.C. Another member of the air staff of No. 11 Group, Group Capt. C. H. Nicholas, D.F.C., A.F.C., has been appointed chief aerodrome control officer, with Flt. Lt. A. R. Combe as his assistant.

MEDICAL BRANCH CONSULTANTS

The vacancy in the post of consultant in medicine that will be caused by the forthcoming retirement of Group Capt. H. A. Treadgold, M.D., B.S., M.R.C.S., M.R.C.P., will be filled by the appointment of Wing Cdr. A. F. Rook, M.R.C.P., M.R.C.S., D.P.H., with effect from May 18.

SPECIALISATION OF OFFICERS AND EX-AIRMAN PILOTS

In order to meet requirements of the Royal Air Force in specialist officers, it has been found necessary to select for specialisation certain of the officers and ex-airman pilots selected for appointment to permanent commissions. The names of the officers so selected for specialisation will be announced in Air Ministry Orders in due course.

STAFF COLLEGE INSTRUCTOR

Sqn. Ldr. W. F. Dickson, D.S.O., O.B.E., A.F.C., with acting rank as wing commander, becomes an instructor at the R.A.F. Staff College in succession to Wing Cdr. H. E. P. Wigglesworth. He graduated at the college in 1927-28, and afterwards served for five years in India. In the War he was an R.N.A.S. pilot, and while serving in H.M.S. *Furious* was awarded the D.S.O. for great skill and gallantry on a long-distance bombing raid. Later he carried out a large amount of experimental flying from carriers, and was awarded the Dunning Cup.

FLYING ACCIDENT

The Air Ministry regrets to announce that, as the result of a collision in the air which occurred near Penang on May 23, between two aircraft of No. 36 (Torpedo Bomber) Squadron, Singapore, the following personnel are missing and believed to have been drowned: P/O. William Mortimer Norman, Corpl. Frank Johnson, Aircraftman 1st Class Alexander French Wilson, Leading Aircraftman Sydney Cyril Hickson.

P/O. Norman was the pilot of one aircraft. Sergt. Alec George Sollis, the pilot of the other aircraft, is safe.

R.A.F. BENEVOLENT FUND

The usual meeting of the Grants Committee was held at Iddesleigh House on Monday, May 18. Mr. W. S. Field was in the chair, and the other members present were: Mrs. L. M. K. Pratt Barlow, O.B.E., Group Capt. C. H. K. Edmonds, D.S.O., O.B.E., and Air Vice-Marshal C. A. H. Longcroft, C.B., C.M.G., D.S.O., A.F.C. The Committee made grants to the amount of £266 8s. 7d. The next meeting was fixed for June 4.

ROYAL AIR FORCE GAZETTE

London Gazette, May 19, 1936

General Duties Branch

The following are granted short service commissions as Acting Pilot Officers on probation with effect from and with seniority of May 4:—G. V. Aylott, L. M. Beavis, J. L. Beck, R. M. Blenner-Hassett, W. B. G. Bonsey, H. L. McL. Bulloch, T. A. Bunting, D. O. Butler, W. P. Cambridge, W. H. Cheetham, P. Corbishley, S. F. Coutts-Wood, C. A. R. Crews, J. W. E. Davies, C. D. Fox, G. E. French, W. R. Gardiner, K. McL. Gillies, I. R. Gleed, I. P. Grant, A. B. Greenaway, D. J. Gudgeon, G. R. G. Henderson, M. F. Hendry, D. J. How, E. A. Hunt, P. H. M. S. Hunt, B. O. Huxtable, A. P. G. Hyde, N. L. Ievers, P. G. Jameson, D. I. Jobson, G. C. O. Key, T. W. Lamb, R. C. O. Lovelock, W. M. Lupton, A. N. Macfarlane, E. W. Mitchell, P. D. F. Mitchell, R. A. G. Morgan, J. F. Newman, G. E. Newton, G. K. Peacock, J. R. Pennington-Legh, F. Phillips, R. D. E. Pitcairn, H. F. Plank, B. J. Rogers, L. G. Schwab, W. T. Scott, R. H. Sleigh, N. J. Starr, J. F. Sutton, H. J. A. Thewles, J. N. de M. Tyrrell, E. R. D. Vaughan, R. N. Wall, W. R. D. Watkins-Lewis, A. G. Wincott, G. S. Woodwark.

The following Acting Pilot Officers on probation are confirmed in rank and graded as Pilot Officers (April 16):—R. C. Ayling, H. R. A. Beresford, M. G. W. Clifford, G. L. A. Cooper, D. V. W. Francis, D. E. Gillam, J. C. Halley, P. M. Hamilton-Hall, P. G. Heath, G. R. Humphries, E. P. W. Hutton, H. H. A. Ironside, H. B. Johnson, H. D. Jones, F. J. Kelly, G. A. H. Kent, T. M. Lockyer, F. A. Marlow, R. A. Milward, P. C. Pinkham, P. H. Richmond, E. G. Rogers, J. B. W. Smith, G. W. C. Watson, J. L. Wells, E. L. Wurtele.

The following Acting Pilot Officers on probation are graded as Pilot Officers on probation (March 6):—G. F. Hall, P. J. H. Harrington, J. H. Sindall.

The following Flying Officers are promoted to the rank of Flight Lieutenant with effect from the dates stated:—L. W. Burgess (April 1); M. F. Calder, V. G. Govett (May 9); F. B. Bristow, C. C. McMullen (May 17).

F/O. A. J. W. Geddes (Lt., Royal Artillery) is promoted to the rank of Flight Lieutenant (April 19); Lt. G. Lassen, R.M., Flying Officer, R.A.F., relinquishes his temporary commission on return to duty with the Royal Marines (May 5).

Medical Branch

The following Flying Officers are promoted to the rank of Flight Lieutenant with effect from May 7, and with seniority of the dates stated:—L. E. A. Dearberg, M.R.C.S., L.R.C.P.; H. L. Willcox, M.B., Ch.B., P. A. Cooper, M.R.C.S., L.R.C.P. (May 7, 1935); A. R. C. Young, M.R.C.S., L.R.C.P. (August 7, 1935); R. C. H. Tripp, M.R.C.S., L.R.C.P. (January 8).

Dental Branch

The following are granted non-permanent commissions as Flying Officers with effect from and with seniority of May 4:—A. P. Britton, A. J. S. Wilson.

R. A. Pepper, L.D.S., is granted a non-permanent commission as Flying Officer with effect from March 9 and with seniority of December 1, 1935 (substituted for notification in the *Gazette* of April 7).

Memorandum

The permission granted to Sec. Lt. L. A. Stuart to retain his rank is withdrawn on his conviction by the civil power (April 23).

Erratum

In the *Gazette* of May 12, for F/O. E. B. Waddy read Flt. Lt. E. B. Waddy.

ROYAL AIR FORCE RESERVE

Reserve of Air Force Officers

General Duties Branch

P/O. J. O. Hedley is promoted to the rank of Flying Officer (September 12, 1935); F/O. J. H. Gladstone is transferred from Class AA (ii) to Class C (May 19, 1935); F/O. C. J. Donovan relinquishes his commission on appointment to a commission in the Auxiliary Air Force (April 11).

Medical Branch

Flt. Lt. N. P. Henderson, M.B., Ch.B., resigns his commission (May 1).

AUXILIARY AIR FORCE

General Duties Branch

No. 601 (County of London) (Fighter) Squadron.—C. J. Donovan is granted a commission as Pilot Officer (April 11); Flt. Lt. N.R. W. Seely relinquishes his commission on completion of service (April 9).

No. 604 (County of Middlesex) (Fighter) Squadron.—F/O. G. S. Wellby relinquishes his commission on completion of service (April 21).

No. 610 (County of Cheshire) (Bomber) Squadron.—A. T. Smith is granted a commission as Pilot Officer (April 9).

AUXILIARY AIR FORCE RESERVE OF OFFICERS

General Duties Branch

N. R. W. Seely is granted a commission as Flight Lieutenant in Class A (April 9).

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified:—

General Duties Branch

Squadron Leader.—H. N. Hampton, D.F.C., to R.A.F. Station, Mount Batten; for flying duties, 11.5.36.

Acting Pilot Officers.—The undermentioned are posted to No. 2 Flying Training School, Digby, with effect from May 2, 1935:—J. S. Adams, A. S. B. Blomfield, W. C. S. A. G. Cooper, D. R. Hopper, B. P. Jones, J. A. W. Lawrence, W. G. Oldbury, P. E. Torkington-Leech, L. M. Blome-Jones, F. L. Chadwick, A. T. B. Campling, P. J. Emerton, D. L. England, J. W. S. Fowler, J. F. Grey, J. M. Holden, J. P. Hopkins, D. P. Hughes, F. A. Ives, L. V. James, P. N. Jennings, R. A. L. Knight, N. B. Mole, A. R. Pruddah, M. P. Richards, F. O. Thresher, F. W. S. Turner, P. F. Webster, and M. L. Wells.

Stores Branch

Flight Lieutenant.—A. A. Quayle, to R.A.F. Station, Upper Heyford, 11.5.36.

Medical Branch

Flight Lieutenants.—T. D. L. Bolan, to Medical Training Depot, Halton, 12.5.36. V. D'A. Blackburn, to No. 1 School of Technical Training (Apprentices), Halton, 11.5.36.

Flying Officer.—R. F. Courtin, to Medical Training Depot, Halton, 1.5.36.

Dental Branch

Flying Officers.—A. P. Britton and A. J S. Wilson, to Medical Training Depot, Halton, 4.5.36.

Special Spanish Furies

AN improved type of Hawker Fury with Hispano Suiza 12 Xbrs engine has been adopted as the standard single-seater fighter of the Spanish Air Force. The initial order for three machines has been completed by the Hawker Company at Kingston and before long three squadrons will have been equipped with aircraft of the same type manufactured under licence by the C.A.S.A. and Hispano Suiza companies in Madrid. The Spanish Government has also acquired the Hawker Osprey with the same power unit, both as a landplane and seaplane. The first machine was delivered by Mr. Hindmarsh a few months ago and a squadron is now under construction in the shops of C.A.S.A., at Getafe. As a landplane the Spanish Osprey has a maximum speed of 180 m.p.h., and as a seaplane is capable of 170 m.p.h.

The Hispano Suiza 12 Xbrs engine delivers 690 h.p. at 13,120ft., and gives the Fury a maximum speed of 236 m.p.h. The climb to 16,400ft. takes six minutes. On test the new combination has proved entirely satisfactory and the handling qualities are in every way comparable with those of the standard R.A.F. type. Another innovation is the cantilever undercarriage fitted with Dowty internally sprung wheels. A photograph appears on page 565.

Welding—From All Angles

NO fewer than twenty-four papers on various aspects of welding will be read during the Twelfth International Congress of Acetylene, Oxy-Acetylene Welding and Allied Industries, to be held at the Caxton Hall, Westminster, from June 8 to 13.

The subjects—all by acknowledged authorities—include: Influence of Welding Methods on the Mechanical Properties of Oxy-Acetylene Welds; Modern Oxy-Acetylene Welding Methods Compared with Electric Arc Welding; Formation of Metallic Nitrates in the Welding of Steels; Corrosion of Welds in Structural Steel; Deposits Obtained by Metal Spraying; Radiography as Applied to Welding; Research on Low-Temperature Steel Welding; Shrinkages and Shrink Stresses in Fusion Welding.

In addition, some thirty other papers will be distributed in printed form to those attending the Congress.

A number of factories will be visited during the Congress, among them being the works of the British Oxygen Co., Ltd.

Full details are obtainable from the General Secretariat of the Congress, 639, Grand Buildings, Trafalgar Square, London, W.C.2.

SUBSIDY SITUATION CLARIFIED

Sir Philip Sassoon, Explaining the Financial Aspects of the Air Navigation Bill, Throws Light on Official Methods of Apportioning Airline Subsidies : Empire Route Plans Among the Other Important Matters Discussed

SOME noteworthy statements on airline subsidies and other topical matters were made in the House of Commons last week by Sir Philip Sassoon, Secretary of State for Air, when the subject of subsidies was discussed during the Committee stage of the Air Navigation Bill. His lengthy speech was of such importance and interest that outstanding points are unabridged in the report which follows. Editorial comment will be found on page 563.

Sir Philip said that the Financial Resolution before the House supplied the foundation upon which the first two clauses of the Air Navigation Bill rested. Moreover, it so happened that it gave financial authority to the Secretary of State for action under those provisions of the Bill about which misunderstanding seemed to have mainly centred. The Resolution covered (1) the proposed subsidy payments to air transport undertakings, and (2) the proposed financial contribution to the Airworthiness Board. It was to the subsidising of air transport concerns that previous discussions had been chiefly directed.

It had been suggested in some quarters that, in dealing with applications for subsidy from air transport companies, there had been some sort of unfair discrimination. It had even been said that it was necessary to know the right people at the Air Ministry. There was no use in mincing words; charges amounting almost to corruption had been made.

Sir Philip, after reiterating that those charges were altogether without foundation, said that he did not propose to content himself with a bare denial. The House was entitled to a full explanation of the precautions taken by the Government and the Air Ministry to ensure that real occasion for such charges should never arise.

British and Foreign Subsidies

There were those who appeared to be opposed to the decision to continue to employ Imperial Airways as "the chosen instrument" for the development of Empire Air Routes, including the North Atlantic. That was not a departmental decision of the Air Ministry. It was the considered policy of His Majesty's Government. Morever, this decision was reached only after an exhaustive review, extending over many months and carried out more than two years ago by a strong Cabinet Committee under an independent chairman. Imperial Airways' record of achievement justified the decision up to the hilt.

He was reluctant to inflict again on the House figures which he had repeatedly quoted but critics who continued to ignore them left him no option. Imperial Airways, in the latest year for which complete figures were available, carried a ton-mileage some 25 per cent. greater than their French, 150 per cent. greater than their Italian, and 50 per cent. greater than their Dutch competitors. He anticipated that the traffic figures for 1935 would make an even better comparative showing.

Turning to subsidies, in 1935 Imperial Airways' subsidy was little more than one-third that enjoyed by the French, about half that of the Germans, and about two-thirds of that of the Italians. Put into different form, whereas the subsidy paid by the French per ton-mile carried in the latest year for which figures were available appeared to have been about 9s., and the corresponding German and Italian figures about 4s. and 11s. respectively, that paid to Imperial Airways was now down to something under 2s.

In the teeth of these facts and figures it was ludicrous to suggest—as had been suggested more than once—that no one travelled by Imperial Airways save for patriotic motives.

Sir Philip went on to deal at considerable length with the fine safety record of Imperial Airways, quoting figures—reluctantly, he said—in comparison with those of other countries.

Imperial Airways' record was not the only reason which influenced His Majesty's Government to come to the decision they had taken. All recent experience in the field of transport and communications had very forcibly driven home the lesson that wasteful duplication must be avoided by all possible means.

The British Government were not alone in the view they took. There were in Europe to-day no fewer than twelve countries which practised the system of a single national air transport undertaking. The French, the Germans and the Italians had avowedly copied our model. Even the U.S.A., in the comparable field of external operation, had adopted the same method. To abandon our system, based, as it was, on the lessons of experience, and when it had attained such success that the world had widely imitated it, would be the height of unwisdom. His Majesty's Government was not prepared for a moment to contemplate such a course.

The Warren Fisher Committee

Sir Philip went on to explain the general methods which govern the selection of companies for subsidy. The selection, he said, was not made by the Air Ministry acting independently and without advice. Decisions were taken in the light of the recommendations of an interdepartmental Committee, under the chairmanship of Sir Warren Fisher. That Committee was not a Treasury Committee; it reported to the Secretary of State. It was a *standing* Committee which advised the Secretary of State on questions of over-sea air communications affecting more than one department—that is to say, on virtually all such questions. Sir Warren Fisher was an independent Chairman, and the Committee comprised representatives of the following departments:—Treasury, Foreign Office, India Office, Dominions Office, Colonial Office, Board of Trade, Post Office, Admiralty and Air Ministry. For anyone to suggest that a Committee so composed could be subjected to undue pressure or influence was manifestly absurd.

Then inside the Air Ministry there was the safeguard of independent financial and contractual control, on which the House had in the past laid such emphasis.

As an illustration of the way Sir Warren Fisher's Committee would normally proceed, when considering the inauguration of a new service, he might say that it had at present under review the possibility of a South Atlantic service. Enquiries had indicated five different "groups" or "interests" which might like to be considered for this South Atlantic service. All five had been invited to submit proposals. He took this opportunity of giving the widest publicity to the Government's intentions in this sphere.

In order that in future there might be no conceivable grounds for grievance or misunderstanding, it was proposed that, so soon as a decision had been reached in principle that a new service should be organised or a new route opened up in an area not covered by existing arrangements, publicity should be given to that decision, whether by announcement in the House or through the medium of the Press, so that all who were, or might be, interested, should have an equal opportunity of submitting proposals.

It had been suggested that all future contracts should be placed on a basis of competitive tendering. In the present state of air transport development, there were serious practical difficulties in the way of such tendering, and they did not consider that it would be in the best interests of the efficient development of air transport—though, of course, the proposals which would be put forward under the procedure he had indicated would be on a competitive basis.

The Empire's Route Mileage

Sir Philip said he must return to Imperial Airways to clear up another point on which there appeared to have been misapprehension. This Resolution and the Bill did not earmark any part of the £1,500,000 to this or any other Company. The Bill merely authorised the Government to spend up to £1,500,000 on subsidies to Imperial Airways or any other undertaking they might select.

Of course, the Empire and projected North Atlantic routes would eventually absorb a substantial proportion of the £1,500,000 maximum specified. Actually, the only major contract at present under detailed discussion with Imperial Air-

ways was for the Empire services, other than the North Atlantic. That contract was expected to absorb an estimated average figure of £600,000 over the fifteen-year period as a whole.

Sir Philip then proceeded to review the plans, already announced, for the proposed speeding-up in the Empire routes, concluding his review with this striking summary:

"When all the services for which we are planning are brought to fruition, the United Kingdom will be operating a route-mileage of over 41,000 miles—that is to say, nearly twice the route-mileage which any other country save the United States is operating to-day. The route-mileage of the Empire as a whole will then exceed even that of America."

All this they hoped to get, as he had said, for an average subsidy of £600,000. When the outline proposals were drawn up, Imperial Airways were receiving a total subsidy of approximately £570,000. The new scheme represented no less than an *eight*-fold increase of ton-mileage capacity for an average subsidy only £30,000 above that figure.

The End of Monopoly

After discussing at some length the pros and cons of the fifteen-year subsidy agreement with Imperial Airways, Sir Philip Sassoon said that it might be asked whether the agreements contemplated under the powers this Resolution would give them were open to the charge of "monopoly." Imperial Airways had to-day under existing agreements a formal monopoly of subsidy over certain routes. *It had, of course, no monopoly of operation.* In the new agreement, the Company *would no longer have in law even the formal monopoly of subsidy.* At the same time, whilst the Government had thought it best that the new agreements should not even give the formal monopoly of subsidy which existed to-day, it had, of course, no intention of giving contracts over the same Empire routes to different competing concerns. That would result in economic chaos.

The new agreement would contain new safeguards against excessive profits. There was, for example, to be a triennial review of operating costs. If it was clear that costs had fallen or were falling, half the resultant savings would accrue to the State.

Again, the Secretary of State, through his accredited officers, would have complete access to Imperial Airways' books and accounts. The Government would continue to have two directors on the Board of the Company, and, by virtue of its deferred shareholding, would take 50 per cent. of any profits in excess of the stipulated rate. Since there seemed to be a mistaken impression current, he would perhaps add that, under the original 1923 agreement, only one-third of the excess profits went to repay subsidies.

Checking Financial "Ramps"

That brought him to another matter which had a close bearing on this point. Of late, the value of Imperial Airways' shares had advanced substantially. There had, however, been nothing in this country like the experience of the United States. The immense losses incurred by the American investing public in the field of air transport and aeronautical development showed that speculation of this kind had nothing to do with our system of air transport organisation. The Government was determined to do everything in its power to prevent any possibility of the "financial ramps," as they had been described, which marred American aviation development.

The worst of those "ramps" were shown to be due to the association of air transport with aircraft manufacture. Imperial Airways, on the other hand, unlike the American companies, had been from the first expressly debarred from interesting themselves in aircraft or engine manufacture, directly or indirectly, without the consent of the Secretary of State. That ruled out one fruitful source of abuse. Fluctuations in Stock Exchange prices however, neither the Government nor the Board of Imperial Airways could control. Everyone knew from experience that at times of great share activity, imagination was liable to outrun reasonable estimates of prospects, and any reasonable investor would be well advised to exercise a wise caution in attempting to forecast the future.

Sir Philip said he had already remarked that the new agreement would contain careful provisions to prevent excessive profits. If, none the less, profits rose above the stipulated figure, the Exchequer, by virtue of its deferred shareholding, would take half the balance.

The authority which the Resolution gave would be exercised with scrupulous fairness. It had been suggested that the attitude of the Air Ministry towards a scheme promoted by a body styled the Irish Trans-Atlantic Corporation changed so soon as Imperial Airways became interested in the Northern route across the Atlantic. Again, he could give the House a positive reassurance. There was not a shred of truth in that suggestion. Imperial Airways were interested in the possibilities of Trans-Atlantic operation by all possible routes long before the Corporation in question approached the Air Ministry. Further, the Air Ministry had at no time received any concrete proposals for the operation of air services from the Irish Trans-Atlantic Corporation. He might add that that undertaking did not, so far as he knew, possess a single aircraft—on the British Register, at all events.

Concern of a like kind had been expressed regarding the reason why British Airways, rather than British Continental Airways, were selected to operate the Scandinavian services. The reason was simple enough. On the recommendation of the Fisher Committee, informal negotiations had been entered into with British Airways, in respect of this proposed Scandinavian service, months before British Continental Airways gave any indication to the Air Ministry that they contemplated operations to Scandinavia.

British Airways were selected after the fullest consideration, because they had far wider operating experience than any other concern save Imperial Airways. The Company was the result of a merger of several undertakings with some years' experience of the operation of regular services, including Continental services. One of the merger companies—Hillman's Airways—had been operating since 1932. British Continental Airways, on the other hand, was only formed in April, and did not start regular operations until July, 1935. Moreover, it was not until the middle of November that British Continental Airways applied to the Air Ministry to extend their Amsterdam service to Sweden. At that date negotiations with British Airways were well under way, and the Fisher Committee, after careful review, adhered to their previous recommendation. They had advisedly selected a company with by far the widest operational experience available; the entry into the field of a new company, which had only been in existence a few months and whose operating experience was exceedingly short and limited in extent, constituted no reason for a change in policy. The Government would be glad to see an amalgamation of these two Companies, to avoid unnecessary duplication of resources and effort.

The Airworthiness Board

Turning to other matters, Sir Philip said there seemed to be an impression current that the service from Singapore to Brisbane had recently been taken over by Australia owing to dissatisfaction with Imperial Airways. On the contrary, this service had been subsidised by Australia and operated by an Australian company in partnership with Imperial Airways since its inception. It had also been stated that American Douglas machines had been purchased for operation on this route. He could only say that he had heard nothing about it at all. Then it had been suggested that South Africa had suddenly begun to purchase German aircraft. The Committee knew that they had had German aircraft for many years. He had seen a report that they were thinking of introducing British engines into those German machines. Anyhow, he was happy to say that the South African Government had ordered a fleet of seven civil aircraft of British design and manufacture.

Sir Philip next dealt with that part of the Financial Resolution which related to the Airworthiness Board. Questions, he said, had been asked as to the composition of the Board. The persons appointed would be men who really knew the essentials of the aircraft industry and air transport. Study of a list of leading personalities of the aircraft industry, from among whom the Board would be in part selected, showed that there was hardly a body of manufacturers in the country with more practical working experience. Apart from this, the Board was to have a staff of experts to assist them. It was anticipated that the Exchequer contribution would be of the order of £12,000 per annum.

The House would very properly be concerned to see that the provision for the establishment of the new Board did not prejudice in any way the making of adequate provision for public safety. Some members, indeed, might be inclined to think that devolution was carried too far. All he could say was that it did not go so far as either the Gorell Committee recommended or the interests themselves would wish.

The Government had felt it essential to retain some control over the airworthiness of the larger passenger-carrying aircraft. As for private aircraft, they had every reason to anticipate that the insurance companies, in their own interests, would provide a sufficient safeguard.

COMMERCIAL AVIATION

— AIRLINES — AIRPORTS —

BROMMA IN ACTION : Transport machines of three nations at Stockholm's airport. On the ground are a British Continental Airways' D.H. 86 A and a Breguet-Wibault of Air France, while in the air is the *Von Hindenburg*, one of D.L.H.'s two Junkers G.38s, which have Jumo diesel engines. The opening of the airport is described on pages 580 and 581. (*Flight* photograph.)

THE WEEK AT CROYDON

The Other Foot : Without Warning : New Traffic Problems : The Kettle Tradition

THERE are passengers who grumble at late departures, others who cause them, and still others who wax wroth if ferocious headwinds hold up an incoming machine. Last week, however, I encountered one who paced the main hall fuming and glancing at his wrist-watch while waiting for his private conveyance. He had come in by one of the lines using Douglas machines, and his had arrived about twenty minutes ahead of schedule.

There are some amazingly unconquerable old people in the world, and, incidentally, most of them fly. Mrs. Harriet Haigue, eighty-five years old, crossed from New York in the *Hindenburg*, and then came on to Croydon from Frankfurt by Imperial Airways. She accompanied some younger relatives to keep them in order, but it seems that they had a job to keep pace with her energy. Prince Axel of Denmark travelled to Scandinavia by K.L.M./A.B.A. Scandinavian Air Express last week, and Sir Eric Geddes accompanied Capt. "Jimmy" Youell aboard an *Atalanta*, which was being delivered out East. Sir Eric got off at Vichy, and "Jimmy" continued "in ballast" to Singapore. Somehow it seems a pity that passengers cannot be booked for these delivery flights, for most of the regular services to the East are fully booked.

Gravesend airport, as I have mentioned before, is regarded as an extremely valuable emergency airport for Croydon when weather conditions, traffic conditions (or a mixture of both), make the London Terminal Airport unapproachable, and it may be noted in passing that there are now two more companies on the Scandinavian route. There is quite an elaborate co-operative organisation between K.L.M. and the Gravesend authorities for bad weather landings, with immediate Customs, passports, and passenger-car facilities. It was somewhat surprising, therefore, to receive a *Notice to Airmen*, which, without any specific explanation, stated (without apology) that Gravesend would be closed to commercial air traffic for about twenty-four hours. Numerous obstructions, mostly invisible from the air, were to be laid out over the landing area.

As we were not told what it was all about, we are entitled to guess that it was a jolly picnic party of high officials, wearing those fashionable green pork-pie hats which would be "mostly invisible from above." Luckily, the weather was good, and the emergency airport was not needed, but one wishes that these parties might, in future, be held at some R.A.F. aerodrome (where there is a proper mess), instead of making a proper mess of air traffic.

On Friday, British Continental Airways' first D.H.86A left Croydon for Stockholm. The machine shows several improvements on the 86, including higher payload for the same engine power and an improved undercarriage. The chairs were specially built to B.C.A. requirements, too, and are remarkably comfortable.

The air freight business is in a flourishing condition, and Air France, especially, reports big and steadily increasing consignments. One day last week K.L.M. had a big machine fully loaded with over a ton of strawberries from Holland.

The opening up of Gatwick deprives Croydon of the services of Mr. Cripps, of the Immigration Department,

whose genial and courteous presence will be greatly missed. I understand that he is to be in charge of the same Home Office department over there. One of our Customs landing officers, too, Mr. Strong, has also gone to Gatwick.

Apparently, the use of Gatwick has opened up new traffic-control problems, and the Air Ministry has decided that the traffic lanes on the Paris run shall be divided into a four-mile corridor—Bexhill-Criel, Hastings-Le Treport will be for Croydon traffic, and another lane for Gatwick machines crossing the Channel from Newhaven to Dieppe. It seems that machines from Gatwick are to be controlled by Heston as far as the coast, then by Croydon across the water until they come under Le Bourget at the French coast—which all seems very complicated and is, I believe, only a temporary state of affairs.

The Imperial Airways Sports Club adjacent to the airport and with a handsome brick-built pavilion was opened last Wednesday by Mr. G. E. Woods Humphery. There are tennis courts, cricket pitches, and football fields, and altogether it is an admirable social centre, which will be very greatly appreciated.

There is something in the air, perhaps, which causes pilots to go all "beaver," or, as our best people spell it, "belvoir." Another young and tender beard has been seen burgeoning upon the manly chin of one of the best-known Imperial Airways pilots. Until it is strong and glossy, I will not divulge his name.

A. VIATOR.

ANOTHER BLIND APPROACH DEMONSTRATION

British Continental Airways' First D.H. 86 A in Service : Down the Beam at Heston

ON Thursday of last week the first of a series of machines in this country to be fitted with blind-approach receiving equipment was demonstrated at Heston. One or two separate machines—notably Imperial's Vickers Vellox, originally intended for the Berlin night run, and Smith's "flying showroom"—have already been so equipped, but British Continental Airways' D.H.86 A's, should be the first to be put into regular service.

Number one of this series of four appeared in public early last week and a full-page sketch of the very special equipment in this machine was reproduced on p. 540a of the special commercial aviation number of *Flight*. In this sketch the Lorenz blind-approach equipment was very clearly shown, and in previous issues for the past eighteen months the methods of using this special equipment have been described from time to time.

During this demonstration the machine was flown by Capt. A. P. K. Hattersley, the chief pilot of B.C.A., and by the arrangement of a series of telephone extensions various interested persons were enabled, once again, to listen to the distinctive sounds of the main and marker beacon signals both while reaching the equi-signal zone and while making the final approach. Unfortunately, a strong wind was blowing directly across the zone line and it was not possible, therefore, to make this approach at a correct altitude or in such a way that a landing could have been made after crossing the last marker.

Furthermore, the fact that there were some eight telephones in use reduced the available power to such an extent that the visual instrument was able to record only the directional indications. A trip in the second pilot's seat, therefore, did not provide any new information over that which *Flight* has already recorded in the description of a journey to Switzerland early this year, during which virtually blind approach was made in very bad conditions.

However, it is satisfactory to know that one company is now equipping its machines with this very necessary receiving equipment and that at least one other will have similarly equipped machines in action in the very near future. Although Heston is, at present, the only airport in this country to have a blind approach system in service, experiments are progressing at Croydon and a similar system should be available there before the coming winter. Equi-signal beacons, too, will be available at one or two other airports in the country.

Several little points which had worried those who were interested in the Lorenz blind approach system were satisfactorily cleared up in the lecture and in the discussion following the lecture delivered by Mr. H. R. Roderwald, of the Lorenz Company, on May 18 at Bush House.

Mr. Roderwald explained that the really important patented feature of the system concerned the regulation of the glide path by the same transmitter as that used for the directional beam. After crossing the first marker beacon the pilot centralises the glide-path indicator for the field strength at that spot and, thereafter, descent below or ascent above the particular part of the field pattern in use caused weaker or stronger signals which were suitably indicated.

Concerning the weight of the necessary receiving equipment, that on B.C.A.'s D.H.86 weighed, with shielding, 120 lb. A lighter receiver is now being made and one is being produced especially for conditions in this country, whereby the pilot can select any one of three different frequencies which may be used at aerodromes which are near to one another.

It was interesting to learn that the D.L.H. course in Lorenz technique for pilots is covered in a matter of a fortnight. All the pilots who have had experience of the system will explain that, while the directional indications are easily followed, a good deal of practice is necessary in the art of holding the correct glide path.

The Happy Ones

THE following candidates have passed the March examination for second-class navigators' licences:—

Andrew, A.; Attwell, M. F.; Batra, R. N.; Bremridge, G.; Carroll, A. M.; Coombes, E. R. H.; Edwards, H. R. A.; Franklyn, A.; Greensted, L. B.; Hanbury, R. D.; Jackson, L. T.; Jobbins, L.; Matthews, F. R.; Monk, G. W.; Mustard, G. E.; Oakley, B. A.; Parker, V. G.; Prowse, D.; Reed, E. G.; Ross, D. G.; Russell, H. C.; Scott, J. E. D.; Smith, F. D.; Sorabie, M.; Stewart, E. G.; Thomlinson, T. G.; Waddell, J. M.; Walker, B.; Wheeler, V. J.; White, L. J. M.; Winton, K. C.; and Woodman, J.

Ninety-one candidates sat. The next examination will be held during June.

The Empire Base

LAST week the Portsmouth City Council decided, by fifty-three votes to one, that a start should be made on the work on the Langstone Harbour flying-boat base scheme which was dealt with in *Flight* of April 16.

The estimated total cost of the scheme is £1,114,850, but the initial work will cost a sum of £271,000. This work involves the dredging of the deep-water runways, the laying out of moorings, the building of hangars, and of an approach road, and must be completed by January 1, 1937. The second part of the scheme entails the landlocking of the harbour by three barrages and work on the new airport.

The Irish Service Opens

YESTERDAY the service between this country and Dublin was due to be opened, operated jointly by Blackpool and West Coast Air Services and the Irish company, Aer Lingus Teoranca. The former will work between Dublin, the Isle of Man and Liverpool, and the latter between Dublin and Bristol.

Paris-Brazil in Thirty Hours

THE introduction of Dewoitine 333's to the Paris-Dakar section of the Air France South American route has resulted in a considerable speeding up of the service. The mail which leaves Paris on Sunday morning is now landed on the Brazilian mainland at Natal on Monday afternoon. The total distance is approximately 5,800 miles, and in its journey the mail is transhipped three times—first at Toulouse from a Breguet-Wibault to a Dewoitine 333, then to a second Dewoitine at Casablanca, and finally to the Transatlantic machine at Dakar. The actual flying time from Paris to Dakar is usually just under 20 hours and the ocean is crossed on the average in rather less than 17 hours

Prospective passengers are told that in August an inter-port service, calling at most of the coastal towns from Dakar to Pointe Noire, and including Freetown, Accra and Lagos, is expected to be opened by the Aeromaritime Company.

Commercial Aviation

A Japanese Pacific Service?

REPORTS from Tokio suggest that the long-expected purchase of airships by Japan may materialise. A new company, known as the Eastern Hemisphere Airways, plans to use two Zeppelins for a service between Tokio, British Columbia and San Francisco.

Organising the G.E.s

A GENERAL meeting of the Association of Aeronautical Ground Engineers will be held to-night (8 p.m.) at the Feathers Hotel, Broadway, London, S.W.1.

Until the appearance of this Association, ground engineers had no supporting body to assist them in their work or to uphold their responsible position as one of the key units in the development of air transport.

Towards Colombo

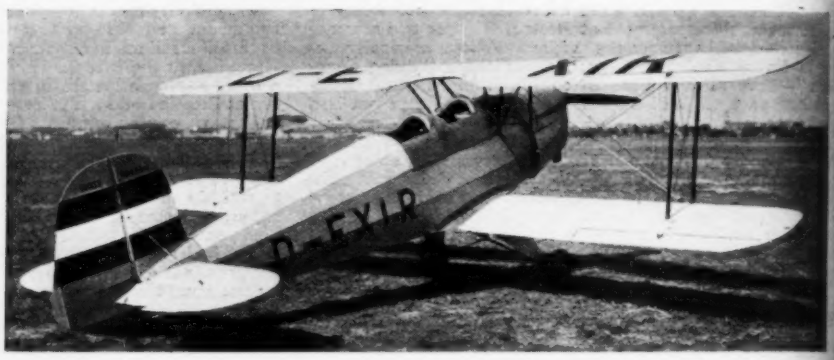
ALL the preliminary arrangements for the extension of Tata's Karachi-Bombay-Madras service to Colombo have been completed, and it was hoped that a new service, to be run twice weekly each way, would by now be in operation. It is understood, however, that progress has been unexpectedly held up at Simla—the seat of the Government of India.

It is unfortunate that any difficulty should be placed in the way of an immediate extension, particularly as it is felt that this extension would pave the way for the time when five services each way will be required to connect with Imperials.

Meanwhile, Tata Sons are seriously contemplating the opening of a passenger service between Bombay and Delhi. According to present arrangements, a bi-weekly service is to be introduced as a beginning, which, should the necessary public support be forthcoming, may later become a daily service.

A CONTINENTAL TRAINER

The Bücker Jungmann Biplane : Lively Performance on 80 h.p.



A small span and ailerons on all four planes give the Bücker Jungmann a good aerobatic performance.

REMARKABLE chiefly for its performance on comparatively low power the German Bücker Jungmann (80 h.p. Hirth) has been designed and developed specifically for school and practice flying. Its construction and factors are such that it is equal to advanced aerobatics, and the constructors state that vertical dives of over 2,000 metres and bunts have been made.

The machine is a two-seater staggered biplane with sweptback wings, which are of wooden construction with spars of double T section. The interplane struts are of steel. Ailerons are provided on all four planes. Welded chrome molybdenum steel construction with fabric covering is employed for the fuselage, while the engine cowling and the top decking round the cockpits are of light metal sheeting. The control surfaces are of welded steel tubular construction and are fabric covered.

The undercarriage is of the divided type, with low-pressure tyres and wheel brakes. Steering on the ground is possible without using the brakes, as the tail wheel is connected to the rudder bar.

Landing shocks are absorbed by springs and oleo damping gear, and the tail wheel has similar equipment.

BÜCKER JUNGMANN BU.131
Two-seater Training Biplane
Hirth H.M.60 R Engine: 80 h.p.

Dimensions	
Span	24ft. 3in.
Length	21ft. 10in.
Height	7ft. 5in.
Wing area	145 sq. ft.
Weights and Loading	
Weight empty	738 lb.
Weight loaded	1,320 lb.
Wing loading	9.1 lb./sq. ft.
Power loading	16.5 lb./h.p.
Performance	
Maximum speed	105 m.p.h.
Cruising speed	93 m.p.h.
Stalling speed	43.5 m.p.h.
Climb to 9,840ft.	28.8 min.
Ceiling	13,120ft.
Range	400 miles.

The engine normally fitted is the 80 h.p. Hirth H.M.60 R. This is an air cooled four-cylinder inverted in-line unit, and it takes its supplies from petrol and oil tanks in the fuselage.

The makers—who are the Bücker Flugzeugbau G.m.b.H., Rangsdorf bei Berlin—particularly stress the machine's stability and vicelessness under all conditions.

A Carden-Baynes Development

A CONTROLLING interest in Carden Aero Engines, Ltd., has now been acquired by Carden-Baynes Aircraft, Ltd., the managing director of which is Mr. L. E. Baynes.

Harland and Wolff and Short Bros.

SOME months ago it was announced in *Flight* that Harland and Wolff, the famous Belfast ship builders, were showing an interest in the possibilities of aircraft manufacture.

The outcome of this interest is an important arrangement, announced last week, by which they will co-operate with Short Bros., Ltd., in the formation of a new company which will construct both marine and land aircraft at Belfast.

Short Bros. emphasise that this development in no way implies lack of facilities for expansion at the existing works at Rochester, but is inspired by the desire of Harland and Wolff, Ltd., to take the fullest advantage of the favourable circumstances which the Belfast site offers.

The new company will have an authorised share capital of £450,000, of which £250,000 will be issued in ordinary shares of £1 each. Of these shares, Short Bros., Ltd., will be allotted a majority holding (60 per cent.), and it is a further term of the agreement that the company shall assist the new company in the installation of all necessary machinery and plant and shall give them the benefit of its technical organisation and designs.

In order to facilitate the subscription of shares in the new company and to provide additional working capital the directors of Short Bros. propose to increase the authorised share capital of the company from £150,000 to £250,000 by the creation of 400,000 ordinary shares of 5s. each, of which it is proposed to issue 120,000.

Boycott